Review Article
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Dental Procedures During the COVID-19 Outbreak: Algorithms and Recommendations

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World Health Organization described novel coronavirus disease (COVID-19) as a pandemic disease on 11th March, 2020. Dentists are a high-risk group due to the inability to provide the necessary social distance for contamination and the possibility of transmission of SARS-CoV-2 responsible for COVID-19 through aerosols and droplets during procedures. In this review, general principles of prevention of contamination, the limits of emergency treatment of dentistry, evaluation of transmission risk of COVID-19 in dentistry and workflow in dental hospitals and clinics.

Keywords: COVID-19, SARS –CoV-2, pandemic, virus contamination, dentistry.

Introduction

In late 2019, a new disease was detected in Wuhan, China [1]. The World Health Organization (WHO) added a new type of disease to the guide by naming this disease Coronavirus (COVID-19) on November 12, 2020 [2]. It has been confirmed that the etiological factor of the disease is the Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) causing the respiratory illness with symptoms of dry cough, fever, shortness of breath, and fatigue [3]. Looking at the prevalence of clinical cases, it is seen that the virus spread to all countries in a short time [4]. Therefore, WHO has declared COVID-19 a pandemic [5]. As a result of the effects of this virus, the American Dental Association (ADA) recommended on March 16, 2020 that routine dental treatments be delayed for a while and only emergency examinations be carried out [25]. Accordingly, ADA has classified emergency dental procedures as follows:

1) Interventions to eliminate uncontrolled bleeding, severe pain and inflammatory conditions that pose a potential serious health risk;

2) Treatments for swelling of the face/mouth, dental trauma, difficulty in opening jaw, and persisting ulcers [26].

COVID-19 is mainly transmitted by respiration, therefore, dental treatments that cause aerosol formation are of additional importance [25]. Thus, the present article evaluated the disease and protection procedures with the protocol need for the actual implementation of dental procedures during and after the pandemic. The protocols in this article cover the dental treatment rules that should be applied to patients in dental clinics during this critical period. The aim is to prevent contamination of this virus and protect dentists and dental assistants while providing emergency treatments to patients.

COVID-19 disease, clinical symptoms and infection routes

Coronaviruses have been shown to be RNA viruses with a single nucleocapsid protein and high mutational properties [6]. COVID-19 has dimensions in the range of 60-140 nanometers and is characterized by its sensitivity to ultraviolet rays and heat. Due to the lipid coating consisting of a double layer, this virus is sensitive to 75% ethanol and chlorine disinfectants. Coronaviruses are a large family of zoonotic viruses that can cause severe illnesses in humans, such as SARS-CoV in 2002 and Middle East Respiratory Syndrome (MERS-CoV) in 2012, in addition to symptoms such as the

common cold [7](Figure-1).

The incubation period of the virus is estimated to be between 2 and 14 days and it has also been reported that this period may extend up to 24 days [8]. The most common symptoms of COVID-19 are fever, weakness, dry cough, dyspnea, myalgia, and diarrhea [9]. In most patients, the disease progresses with mild symptoms and can result in death from high fever, pneumonia, acute respiratory distress syndrome (ARDS) and renal failure. While most infected individuals experience mild to moderate respiratory symptoms, severe respiratory syndrome occurs in 5 to 10% of infected individuals [10]. COVID-19 is practically spread by asymptomatic infected individuals. The 0.2% COVID-19 mortality rate in young people increases with age and the presence of systemic disease (comorbidity) [11]. Laboratory tests for the disease show leukopenia, leukocytosis, and lymphopenia [9, 12]. In the chest computed tomography (CT) examination of the disease, consolidation anomalies (increased fluid in the alveoli) and / or only opacification (ground glass appearance) are observed on the background of viral pneumonia [13]. It has been shown that elderly individuals with a weakened immune system and chronic systemic diseases are more likely to be contaminated with SARS-CoV-2 [9]. Although it is not possible to determine the exact number of clinical deaths (CFR) in the world, it is estimated that there are 4.5% deaths in this disease. The death toll is lower than the Azerbaijan Republic Medical Institute and the Operational Headquarters affiliated with the Council of Ministers. This is because our state has proven to be positively correlated with the correct isolation measures given ahead of time.

The virus attaches to the ACE2 receptor in respiratory system cells. Therefore, patients using cardiac drugs containing ACE2 inhibitors should be more careful. Even if the infected cells die, millions of copies of the RNA complex can remain in the cells. In severe cases, the immune system reacts autogenously, severely damaging both the virus and our own cells, leading to death from acute pneumonia. This coronavirus type enters our body through the nose, mouth and cornea of the eyes and settles in the upper respiratory tract and lungs. The infection spreads through coughing, sneezing and direct drip over short distances. Indirectly, when we come into contact with infected surfaces, we can be contaminated by touching our nose, mouth and eyes with our hands. In addition, the virus has been seen to spread up to 8 meters by coughing and sneezing [27]. According to experiments, the virus lives in the environment in aerosol (air drop) droplets for at least 3 hours, and the presence of the virus has been observed even in blood and feces [14]. The virus can stay on inanimate surfaces such as metal, glass and plastic for up to 9 days, depending on surface properties, ambient temperature and humidity [15].

The situation of the COVID-19 pandemic in the world and in the Republic of Azerbaijan

On February 28, 2020, the Operational Headquarters of the Cabinet of Ministers of the Republic of Azerbaijan confirmed the emergence of the first coronavirus (COVID-19) infection in Azerbaijan [28]. REACT Co-19 project, the hospital and the

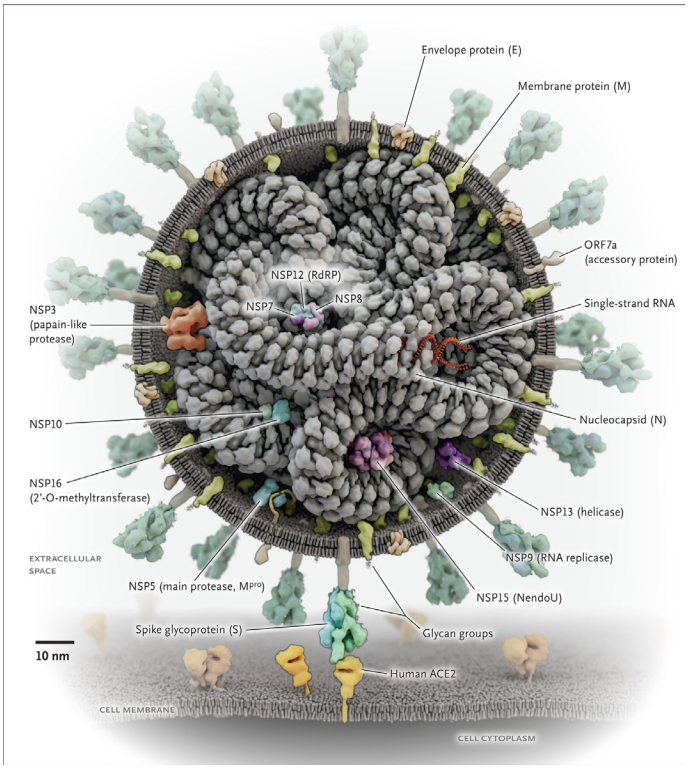

Figure 1. Schematic description of the SARS-CoV-2 virus structure [16].

planned creation of full-fledged branch team, working citizens of the Republic of Azerbaijan and the Republic of Turkey have brought to the country fight the pandemic is provided.

As of May 25, 2020, according to WHO data, a total of 5,304,772 COVID-19 cases and 342,049 deaths were detected in 227 countries worldwide. At this time, 4122 COVID-19 patients were identified in the Republic of Azerbaijan, only 49 deaths were recorded [29]. Clinical symptoms and radiographic findings are similar to other symptoms of respiratory viral infection and make early diagnosis of COVID-19 patients difficult. The fact that most cases are in the development stage of the disease leads to a higher than expected mortality rate. The incidence-mortality rate is expected to decrease further as more tests are performed on mild and asymptomatic infections. However, this low mortality should not be considered as a risk of common disease [17].

Contamination risks with COVID-19 infection in dental clinics and hospitals

Considering the pandemic process, doctors, resuscitation workers, dentists, paramedics, nurses, landlords, truckers are in the most risky work areas. Especially ophthalmologists, ear and throat specialists and dentists are at high risk due to close contact with COVID-19 positive asymptomatic patients [30]. Dentists and patients may be exposed to oral and respiratory viruses during dental treatment, become contaminated by pathological microorganisms and become carriers of these microorganisms. Inhalation of aerosols and airborne particles in dental procedures is considered as a high risk of contamination

as bronchoscopy [31]. COVID-19 transmission has been shown to occur in dental clinical practice because patients do not know whether they are infected or hide their disease during the incubation period [18]. Thus, in dental procedures, it has been proven that patients have a droplet infection that is ejected from the oral cavity and that aerosols can spread this infection over long distances [19]. SARS-CoV-2 can be transmitted directly or indirectly through speech, coughing, sneezing and saliva. Studies have shown that the saliva of infected people preserves the viability of the virus [20]. Infection routes during dental procedures for SARS-CoV-2 infection can be grouped under the following headings: 1) insufficient social distance (less than 1 meter); 2) inhalation secretions and airborne fluids, contact with nasal and eye mucosa; 3) direct contact with blood, oral fluid and other used means; 4) exposure to droplets and / wow aerosols caused by infected persons during speech and coughing [9].

Protocol for Preventive Measures in Dental Treatments During the COVID-19 Pandemic

Even if the body temperatures of the patients and their accompanying persons are measured with a digital infrared thermometer at the entrance to the clinic, these individuals may be asymptomatic. Therefore, asymptomatic and suspicious patients should be distinguished. To do this, dentists need to know how SARS-CoV-2 spreads, the symptoms of contaminated patients, and practical preventive measures [21]. The protocol on preventive measures prepared for hospitals and clinics by the Ministry of Health of the Republic of Turkey Coronavirus Scientific Committee is given in the table below (Table 1) [32].

Remote Evaluation

In order to reduce direct contact, it has been shown that taking an anamnesis by phone and online recording is useful in evaluating persons suspected of having SARS-CoV-2 [33]. In this context, the Republic of Turkey, China, many mobile application has been developed to detect persons in contact with people in Israel and the United States. The body temperature of the patients and their attendants should be measured with the infrared forehead thermometer. In addition to COVID-19, dental abscesses, periapical cysts and pericoronitis should not be ignored in any patient with high fever. Before ddental procedure, a careful history should be taken and treatment consent forms should be signed after all questions (related to SARS-CoV-2) are answered as "no". Triage protocols (selection and classification according to the importance of the patient's emergency medical care) can be created according to the severity of the patients' complaints. This is necessary to protect both medical personnel and the patient. Clinical staff should also actively follow the rules applicable to patients (non-contact temperature measurement at entry, social distance and mask). It is important to identify elderly individuals with a history of chronic disease and weakened immunity. These individuals increase the risk of infection for both themselves and their patients [33].

Personal hygiene

The WHO stated that washing hands with soap for at least 20 seconds reduces the risk of infection. Dentists should be careful not to touch their face and eyes [21]. Hand washing should be done carefully after dental procedures and when changing protective overalls. The SARS-CoV-2 virus was also inactive with the use of 752% ethanol for 30 minutes in 56 ° C water [22].

Personal protective equipment should include long sleeved disposable gowns, disposable hats, surgical face masks, face shields, goggles, and gloves. When personal protective equipment is put on and taken off, it should be listed separately as hat, apron, mask, goggles, face protection and gloves (Figure-2). Gloves should be changed regularly as fluid leaks during long procedures. The entire eye part should be protected from the top, bottom and sides with closed glasses. N-95 and FFP3 masks should be worn during all procedures that cause airborne droplets [18]. Unfortunately, finding N95 masks today is very

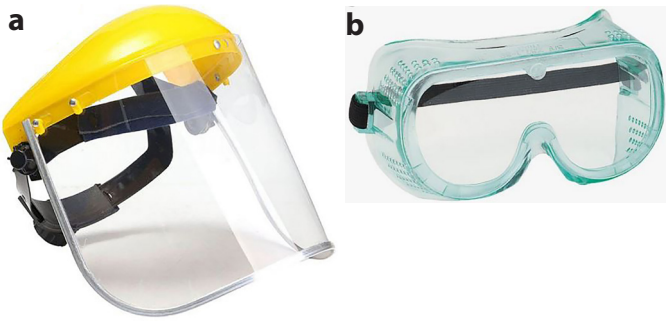

Figure 2. a. Face shield, **b.** Vacuum goggles.

Table 1. Protocol of preventive measures to be taken during the COVID-19 pandemic in dental area.

Place	Person	Procedure	Prevention
Waiting room	Health-care worker	Remote evaluation (non-oral)	Minimum 1 m distance to the patient. No need for protective clothing (mask should be worn if distance is not maintained).
	Patients with symptoms	In every procedure	A distance of 1 m must be maintained. Patient should wear a mask. Non-emergency services should be postponed.
Dental clinic	Medical staff and everyone in the room	Dental procedures	0.91 N95 or FFP2 or equivalent mask,gloves, goggles, face shield, aprons, and bonnets.

Figure 2. a. N95, **b.** FFP2, **c.** FFP3

difficult and expensive for us. N95 masks provide at least 95% of 0.3 micron particles, FFP2 masks 94% and FFP3 99% filtration (Figure-3). Dental clinics should be ventilated and disinfected before and after admission. Medical personnel should remove the protective equipment in the room where the procedure is performed and use a surgical mask outside the room. A disposable protective cover can be used on the feet. After each patient, glasses and face masks should be cleaned and wiped with soapy water and a disinfectant containing at least 70% alcohol.

During dental procedures, physician precautions should be taken in two different stages against the possibility of the spread of SARS-CoV-2 infection:

Basic protective measures: Disposable headgear, disposable surgical mask + N95 or FFP3, white coating, protective goggles, face protection caps, use of disposable latex or nitrile gloves.

Enhanced protective measures: The use of supplemental disposable insulating clothing (overalls) and / or work gowns should be considered.

The order and importance of dental procedures

It is recommended to use extraoral (oral) methods (panoramic x-ray and volumetric tomography-CBCT) among the x-ray examination methods used for diagnosis at the beginning of dental procedures [18]. Procedures for patients with cardiovascular disease should begin with appropriate consultation and antibiotics for endocarditis prevention according to the protocol of the American Heart Association. Before examination and treatment, patients should be given 1% hydrogen peroxide solution and 0.2% povidone-iodine solution to gargle [21]. During the COVID-19 pandemic, limited use of local anesthetics with a strong vasoconstrictive effect is recommended [23]. The use of rubberdam in endodontic treatments may facilitate the absorption of air droplets by an aspirator without spreading over a large area and being swallowed by the patient. There are no restrictions on the use of postoperative antibiotics in accordance with the protocols. Non-steroidal anti-inflammatory drugs (NSAIDs) have been reported to be prescribed other pain relievers as they cause immunosuppression and exacerbate respiratory problems [24]. The use of NaOCL (sodium hypochlorite) solution in endodontic therapy has been shown to be successful as it successfully eradicates COVID-19 infection. Furthermore, the later stages of pre-existing endodontic therapy may be delayed according to treatment. Vital pulp tests should be performed in patients with endo-perio lesions and periodontal consultation should be provided. Teeth with suspicious prognosis and less likely to respond to treatment should be extracted (34).

Ultrasonic cleaning of dental calculus should be delayed due to the spread of airborne infections in the area, and patients should be advised to follow oral hygiene rules during the COVID-19 outbreak. Cleaning of dental tartar should be done with hand tools such as SRP (scaling and root planning).

Surgical procedures such as mouth abscess and periapical cyst treatment should not be delayed and should be treated according to protocols. Perio-plastic surgery methods, procedures such as dental implants and bone augmentation may be postponed.

Filling can be applied to broken teeth due to trauma. Although splinting of teeth that are completely removed from the alveolar socket has been recommended, replantation is not recommended [18].

In prosthetic procedures, disinfection should be taken into consideration in the necessary measurement and transportation. Additionaly, high-speed tools should not be used as much as possible (23).

Conclusion

Today, all features of the SARS-CoV-2 infection are analyzed in depth. In the field of dentistry, dentists should create their work plans based on this information and adapt their service protocols according to the pandemic duration. Dentists should acquire equipment with strong aspiration characteristics to protect both medical staff and patients from contamination.

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