

## Infection Control during COVID-19 Outbreak in a University Dental School

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### Abstract

**Background:** After almost three months of quarantine due to COVID-19 pandemic the national authorities in accordance with the administration of the Dental School of the National and Kapodistrian University of Athens, made a huge effort to reopen the dental clinics of the School of Dentistry.

**Methods:** The clinics were divided into three categories depending on the production of aerosol. Safety protocols for all personnel, students and patients were incorporated into daily routine. Labs, clinics and examinations were under surveillance of the Infection Control Committee of the School. All groups of students were subdivided, and appropriate distances were kept in all clinics and auditoriums. Strategies to lower patient attendance, reduce of aerosol, check the indoor air quality, monitor all visitors, control sterilization process and waste disposal are discussed further in this paper.

**Results:** Many of the guidelines incorporated urgently due to the pandemic, are about to remain in many settings of the Dental School for future evaluation and better function of labs and clinics.

**Conclusion:** A period of two months for training dental students in advanced safety protocols is needed while reopening due to COVID-19. The cost for protective equipment and single use materials tripled during the operation of dental clinics and laboratories due to COVID-19. The amount of hazardous waste produced in the dental clinics doubled in a period of two months. Public health can be protected if safety protocols and use of protective equipment is used by both staff and students.

**Keywords:** COVID-19; Pandemic; PPE; Safety protocols; Public dental sector; Precautions; Dental school

### Introduction

Coronavirus Disease-2019 (COVID-19) was declared a pandemic by the World Health Organization, with a high fatality rate that may reach 8% [1] and keeps going on. It applies to the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) [2]. As of 26 April 2020, there have been more than 2.9 million cases, and more than 205,000 deaths globally [1]. In response to this challenging pandemic, the Center for Disease Control and Prevention (CDC), American Dental Association (ADA), the National Health Service (NHS), the Hellenic National Public Health Organization (ENPHO), the Greek Dental Association (EOD), as well as other health regulatory bodies all over the world, have provided advice to dentists to regulate dental services and guidance in order to protect themselves, their co-workers and their patients from this infection.

Dentists are among the highest risk categories for transmission and contraction of the coronavirus, with many routine dental procedures having the potential to transmit the virus through creation of aerosols. It is already reported, that although it is important to provide treatment for patients who present with urgent or emergency dental procedures, the primary and most important goal should be to prevent transmission of infection to patients and dental healthcare personnel [2,3]. The growing fear of cross-infection, and the possible role of dental practice in spreading the infection, have obliged dentists to step aside and to confine themselves in home quarantine from March to almost end of May 2020, like other non-healthcare parts of the population in Greece and worldwide.

Due to the burst of the pandemic, there has been an increased demand for personal protective equipment (PPE) to protect healthcare workers or any other person of getting infected [4]. All proposed equipment; (face protection, mask, goggles, face shield, gloves, gown or coverall, head cover, and rubber boots) confused dentists and created a false or newborn alarm in the market that elevated the need for air

clearing equipment and other prevention and protection measures and materials. This need is in a direct relationship to the elevation of the functional costs of dentistry and the amount of dental waste produced to the environment.

WHO data on 10th June [1] were reporting for Greece a total number of 3.058 confirmed cases, 9 new cases, 183 total deaths and only 1 new death. These data corresponded to one of the lowest in Europe. On October the 26th, there was a relative raise of 77,21 % on the total number of daily new confirmed Covid-19 cases per million people in Greece, indicating that serious measures planned before the reopening of the boarders on the 15th of July, should be strictly followed in all private and public dental sectors [5]. The national authorities and the Hellenic Dental Association (EDA) had issued specific guidelines for infection prevention and control for healthcare facilities, including dental schools and had trained healthcare personnel for these measures all over the country ([www.eody.gov.gr](http://www.eody.gov.gr)) [6,7].

So far though, the main bulk of published research directed to dentists, has mainly focused on giving a background on the pandemic and what the recommended cross-infection control measures are [8-12]. No published data were found on the reopening of closed dental schools after the quarantine and the measures taken from the administration and the national authorities for the safety of students, personnel and patients in such cases [13]. Accordingly, in this paper,

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the guidelines applied due to the pandemic by the administration of the Dental School of the National and Kapodistrian University of Athens, are discussed.

## Materials and Methods

For the safe entry in the Dental School specific measures had to be taken at the following levels:

### Strategies for entering and signaling

Entrance/Exit to the Dental School was allowed only by the main entrance door in order to practically establish a tracking system for people entering the School signed by personnel in a submission book. All patients were asked by phone before the appointment and sign a certain consent form in every clinic of the School (Table 1). A polymeric carpet soaked with a 12% quaternary ammonium solution for disinfection of shoes was placed in front of the main entrance. Special printed labelling with all obligatory guidelines was introduced in all entrance doors of clinics, laboratories, library etc. Finally, all protocols and guidelines were introduced at the main webpage of the school with other relevant safety material (<http://www.dent.uoa.gr/>).

- Do you currently have any of the following symptoms or have you had any of the symptoms within the past 14 days?

Communication over the phone	
	Appointment at the Dental School
	DATE:
1. Fever and/or chills, or have you had a fever or felt hot and feverish recently (14-21 days)?	
i. If yes, how high was the fever?	Yes <input type="checkbox"/> No <input type="checkbox"/>
2. Difficulty in breathing/shortness of breath?	Yes <input type="checkbox"/> No <input type="checkbox"/>
3. Cough or sore throat?	Yes <input type="checkbox"/> No <input type="checkbox"/>
4. Fatigue, headache?	Yes <input type="checkbox"/> No <input type="checkbox"/>
5. GI Symptoms	Yes <input type="checkbox"/> No <input type="checkbox"/>
6. Recent loss of taste/smell?	Yes <input type="checkbox"/> No <input type="checkbox"/>
7. Have you had close contact with someone diagnosed with COVID-19 in the past 14 days?	Yes <input type="checkbox"/> No <input type="checkbox"/>
8. Do you belong in a high-risk group?	
i. If yes, please describe:	Yes <input type="checkbox"/> No <input type="checkbox"/>

Table 1: COVID-19 screening questionnaire.

Further suggested questions for the questionnaire related to Table 1:

- What is the purpose of your visit today? (Faculty, Staff, Patient, Student, Visitor)
- Have you been diagnosed with COVID-19 in the past 14 days? (Yes/No)
  - i. If yes, have at least 3 days passed since recovery and 14 days passed since first symptoms? (Yes/No)
- Have you been diagnosed as a "Person under Investigation" for COVID -19 now or in the past 14? (Yes/No)
- Have you traveled outside the country in the past 14 days? (Yes/No)
  - If so, where? \_\_\_\_\_
- Have you taken any fever reducing or cough suppressant medication in the past 72 hours? (Yes/No)

### Strategies in laboratories

The laboratories of the Dental School were the first sectors to re-open after the quarantine. This way, the Administration could have gradual control of the number of people entering the School. A new dress-code and guidelines protocol was established. It constituted of a standard surgical mask, scrubs, head cover and closed athletic shoes. Students should be prepared through educational material placed in the e-class lessons in order to perform minimum live group performances and avoid close contacts with supervisors. They were divided into subgroups. All materials and tools were placed by assistants. A 30 minutes break for air renewal and disinfection of the hard surfaces before entrance of the second subgroup was performed (Figure 1).



Figure 1: Students performing lab exercise under relevant distances and appropriate dress code.

### Strategies in clinics

The guidelines for students and personnel entering the clinics were established according to the level of the production of aerosol (Table 2). The main directions consisted of good hand hygiene and use of extra protective equipment. All contaminating objects were removed from waiting and operating rooms (magazines, etc.). Regular sanitizing was taking place of the common and operational areas, non-medical furnishings, equipment and surfaces accessible to the patients (handles, etc.). Disposable protection barriers (plastic film or cover) were also placed on points of sale (POSs), keyboards, etc. Students should arrange only the necessary material on the surfaces of operating areas, (no mobiles, paper sheets, personal things etc. The operative surfaces were disinfected with hydroalcoholic disinfectants at concentrations above 60%, while patients mouth rinse for 30 s with a 1% solution of hydrogen peroxide (1 part at 10 volume 3% hydrogen peroxide and 2 parts of water). Extra-oral over intra oral radiological examinations were chosen in order to avoid the stimulation of coughing or vomiting [2,14]. Only the dental assistants should pass by the student's unit for collecting the used equipment.

Aerosol free clinics	Aerosol potentially producing clinics	Aerosol producing clinics
Oral radiology	Oral diagnosis clinic	Oral surgery clinic
Oral pathology	Orthodontics clinic	Maxillofacial surgery clinic, Paediatric dentistry clinic
Orofacial pain and TMJ disorders clinic	Implantology unit	Emergencies, Total care clinic
Hospital dentistry clinic		Postgraduate clinics of Periodontology, Prosthodontics, Endodontology, Restorative dentistry

Table 2: Classification of the clinics of the Dental School according to their therapeutic activities in A. The aerosol free Clinics, B. The aerosol potentially producing clinics and C. The aerosol producing clinics.

For the clinics producing aerosol, a full coverage rubber dam (wherever feasible) was introduced [15]. All surgical suction systems were monitored for possible leaks, since this might produce spread of pathogens. Also, the use of air syringe should be avoided or eliminated. The use of resorbable sutures was suggested in order to avoid a second appointment with the patient.

Thorough suggestions were made for personal hygiene procedures at the end of the students' shift. The following sequence was obligatory for putting on the Personal Protective Equipment (PPE) combination: first one pair of gloves then gown and head cover; then FFP2 mask; then goggles or face shield; then second pair of gloves (Figure 2). Then the following sequence was obligatory for removing PPE: first pair of gloves; then goggles or face shield; then gown; then second pair of gloves. All disposable protective equipment should be disposed in the special labeled stands. Careful attention should be given to prevent contamination of clothing and skin during the process of removing all PPE. Undergraduate students could see only one patient per session. In case of two scheduled appointments in the same session, the first patient should be escorted out of the clinic prior to bringing the second patient in.



**Figure 2:** Arrangement of strictly necessary material on the surfaces of the operating areas, use of rubber dam and full protection applied protocol in aerosol produced clinics.

### Strategies for patients

Patients were entering the Dental School only with a direct call from the secretary of the clinic. The students should be ready to accept them immediately without waiting in the reception areas. Patients were waiting outside the School at an open kiosk. No seats were kept in the reception areas inside the School in order to avoid cross contamination. Patients should circulate the minimum within the School. All surfaces should be disinfected before and after their departure. Finally, escorted members were allowed only for the pedodontics department and limited to one person per child.

### Strategies for air quality of the clinics

The indoor air quality control was of great concern in the Dental School of Athens, since 2008 [16-18] due to the use of polymeric substances, detergents and other dental materials. Although volatile compounds were found to accumulate in the corners of the rooms [18], the natural ventilation was suggested to be limited due to infection control reasons [19-21]. Air removing fans at the ceiling and air suction tubes in close vicinity to the dental units, installed almost a decade before, would help exhausting approximately 3600 lt of air per hour in six sequences. The previous system was further renovated due to the pandemic (Figure 3). Additionally, removable air purifiers, equipped with HEPA filters (High Efficiency Particulate Air/Absorbance) [22], were installed in aerosol produced clinics (4 units every 150 m<sup>2</sup>).



**Figure 3:** Air cleaning and circulating system in the clinics producing aerosol.

### Strategies for sterilization process

The sterilization process was always performed through the Central Sterilization Unit (CSU), operating in specifically designed area and equipped with every currently proposed and available infrastructure (instruments' washers, sonication devices, autoclaves, foamers, dryers, envelope sealers and biological monitoring incubators). All tools were handled with the help of specially designed stainless steel wheeled toolboxes, with each containing plastic containers for septic collection and sterile delivery, specially signed, color coded and accompanied by certified personnel. The program of sterilization was evenly changed in order to have time between the shifts, for the correct cleaning, packaging and sterilization process. Based on the specifications of the Clinics, standard sets of tools were created, depending on the requirements of the therapeutic work carried out by the students.

### Strategies for waste disposal

Dental clinics produced daily large quantities of solid and liquid wastes. Until 2003, the typical practice performed by the dental personnel i.e. dentists, dental chairside assistants and the janitors was to dump most dental solid wastes into household disposal cans and landfills, without any separation, sterilization or even disinfection process. Since then, used sharps (needles, scalpels and burs) were separated and stored in labeled yellow plastic boxes and instrument were also deposited in the municipal disposal areas. Existing Hellenic law 4042/2012, enforcing European Directive 2008/99/EC on the protection of the environment, proposed a mandatory mode for collecting and handling the hazardous and infected medical wastes, commissioning either incineration or heat disinfection (sterilization) system. In the pre-Covid-19 era, the Dental School produced daily approximately 700 litres of either hazardous or infected solid waste, containing paper, plastic, latex, various metals, glass and remnants of dental materials. In full operation of the clinics scheduled from October 2020, it is estimated that the waste will triple. All waste were collecting in new, special construction, color coded and relatively labeled large disposal bins of 120 liters capacity. Separating and sealing of all hazardous waste was performed in proper bags and containers in order to prevent human contact with them according to national and WHO guidelines [23,24].

### Results

Our goal was to re-open with safety the Dental School of the National and Kapodistrian University of Athens and develop protocols for the application of preventive and protective measures [25-28]. The basic results achieved by opening gradually the laboratories and then the clinics of the School were the following: 1) all students were adequately educated on the PPE, 2) patients were responsibly informed on the strict hygiene measures performed within the buildings, 3) technical measures for air quality and waste control improved the

working conditions, 4) the social image of the School was improved within the University and the community in general.

More specifically, among the previous described organizational, environmental and personal preventive measures and equipment, the control of the physical and air conditions and the detailed medical history form completed through phone call one day before arrival of the patients could be used further for any subsequent endemic SARS-CoV-2 waves. Further, it should be mentioned that subdivided all students in groups of 15 persons made theoretical examinations and clinical performance more productive. Smart working in the clinics where one patient can stay for double appointments in order not to come repeatedly, resulted in less people entering the Dental School every day. Also, obligatory use of standard surgical mask in entering the buildings seemed to educate both patients and personnel on the necessary and responsible social behavior needed for the situation [29-31]. Finally, categorizing the clinics according to their potential in producing aerosol made possible the control of the quantities needed for protective equipment and the amount of waste produced.

## Discussion

Educational actions for staff and students are needed repeatedly in dental university sectors. Based on literature data, all relevant to the pandemic knowledge should be under constant spread within the School either through lectures or written guidelines on the site of the school or e-class lessons. This way, students seem to feel more secure in performing clinical work. Another issue of importance that needed administrative decision was the use of FFP2 masks in the aerosol produced clinics. Despite the absence of scientific evidence [32-35], FFP2 masks were given to students in aerosol produced clinics in order to be reused for 8 hours in total, together with a combined set of protective shields/goggles and two pair of gloves [29-31,36-40]. It is further investigated whether multiple use washable robes made of sterile fabric for all staff members and students could diminish the quantities and cost of waste disposal. Finally, the adoption of strict protective protocols guarantees that the emergency management can be optimized, ensuring the continuation of normal activities and ultimately contributing to reducing the risk of contamination of the students, the educational and administrative personnel, the incoming patients and the rest of the visitors.

## Conclusion

- A period of two months for training dental students in advanced safety protocols is needed while reopening university sectors due to COVID-19.
- The cost for protective equipment and single use materials tripled during the operation of dental clinics and laboratories.
- The amount of hazardous waste produced in the dental clinics with the use of the advanced protective protocols, doubled in a period of two months.
- Public health can be protected if safety protocols and use of protective equipment is used by staff and students according to the aerosol produced dental clinics in dental schools.
- Measures should be taken by the administration of public dental sectors for reducing single use protective equipment in order to diminish the quantities and cost of waste disposal and protect the environment.

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## Conflicts of Interest

The authors declare no conflict of interest.

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