


RETURNING TO THE ORTHODONTIC PRACTICE AMID COVID-19 CRISIS

Letizia Perillo^{1a}, Ludovica Nucci^{1b}, Oded Yitschaky^{2c}, Gennaro Carrino^{1d}, Rossella Carrino^{1e}, Stella Chaushu^{2f}¹Multidisciplinary Department of Medical-Surgical and Dental Specialties, School of Dentistry, University of Campania Luigi Vanvitelli, Naples, Italy²Department of Orthodontics, Faculty of Dental Medicine, Hebrew University-Hadassah, Jerusalem, Israel^aMD, MS, PhD, Professor, Head, Dean; e-mail: letizia.perillo@unicampania.it; ORCIDiD: <https://orcid.org/0000-0001-6175-7363>^bDDS, PhD Student; e-mail: ludortho@gmail.com; ORCIDiD: <https://orcid.org/0000-0002-7174-7596>^cDMD, MA; e-mail: oyits76@gmail.com; ORCIDiD: <https://orcid.org/0000-0002-5732-532X>^dMD, MS, PhD; e-mail: gencarrino@gmail.com; ORCIDiD: <https://orcid.org/0000-0002-9179-0751>^eDDS, Postgraduate Student; e-mail: rossella.carrino1@gmail.com; ORCIDiD: <https://orcid.org/0000-0003-0417-5791>^fDMD, MSc, PhD; e-mail: drchaushu@hadassah.org.il; ORCIDiD: <https://orcid.org/0000-0001-9571-8338>

ABSTRACT

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Background The coronavirus disease (COVID-19), caused by the novel severe acute respiratory virus syndrome (SARS)-CoV-2, was defined as pandemic on March 11, 2020. All health care providers are at risk of a COVID-19 infection; however, dentists pose the highest risk since SARS-CoV-2 is transmitted through breathing and aerosol, coughing and droplets and direct or indirect contact with infected skin and surfaces. Guidelines for minimizing the risk of transmission in general dental clinics have been published and are regularly updated.

Objective The present article aims to specifically address the concerns of the orthodontic profession amid the COVID-19 crisis, and suggest recommendations for orthodontic care settings, infection prevention measures and delivery of clinical procedures.

Data Sources An electronic search was conducted via PubMed/MEDLINE, Google and health organization websites from two independent data abstractors.

Study Selection All kinds of manuscripts describing guidelines for health care providers to follow during the COVID-19 pandemic were included. No language restrictions were considered. Any disagreements on study inclusion were resolved by discussion between the two reviewers.

Data Extraction Information on guidelines and suggestions on the management of clinical orthodontic practice were extracted from studies identified for inclusion in the review.

Data Synthesis Orthodontists are at a very high risk for COVID-19 infection and all published guidelines should be followed for the patient and DHCPs safety. The care settings, the infection protocols, and the delivery of AGP clinical procedures must be continuously revised and modified to overcome the threat of the SARS-CoV-2 infection in the orthodontic practice.

KEYWORDS

COVID-19; Saliva; Aerosol; Orthodontists; Clinical Practice.

1. INTRODUCTION

The coronavirus disease 2019 (COVID-19) is a clinical syndrome caused by the novel Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), a pathogen closely related to the Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) and Middle East Respiratory Syndrome Related Coronavirus (MERS-

CoV). SARS-CoV-2 mainly attacks the respiratory system, due to its affinity to angiotensin-converting enzyme 2 (ACE2) cell receptor, highly expressed in the lungs and the heart [1]. COVID-19 appears to have a lower case-fatality rate (3.4%) as compared to SARS-CoV (10%) and MERS-CoV (3.4%) [2], but is more transmissible, therefore posing a major public health threat. Most people infected by COVID-19 present

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***Corresponding author:** Prof. Dr. Stella Chaushu, Professor and Chair, Department of Orthodontics, Faculty of Dental Medicine, Hebrew University-Hadassah, Jerusalem, Israel, Address: PO Box 12272

Tel.: 972-2-6776184; Fax: 972-2-6427613; e-mail: drchaushu@hadassah.org.il

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mild, inconsequential respiratory symptoms. However, a minority of often aged individuals with other medical conditions, develop a severe disease, clearly distinct from the well-known acute respiratory distress syndrome. The disease is caused by a cytokine storm, a form of systemic unrestrained inflammatory response featured by the abundant release of pro-inflammatory cytokines [3].

This leads to alveolar injury, increased vascular permeability and extravascular accumulation of edema fluid, culminating in respiratory and heart failure, thromboembolism and death [4]. COVID-19 was declared as a pandemic by the World Health Organization (WHO) on March 11, 2020.

The current approaches to treatment include vaccine development and discovering new or re-proposed anti-viral and immunosuppressive medicines [5]. Unfortunately, pharmacologic treatments and vaccines are not yet available and it is likely that a high number of asymptomatic carriers [6] contribute to the spread of the virus. Currently, isolation and social distancing seem to be the most effective weapons against the virus and its widespread [7].

In this gruesome scenario, health care providers are extremely vulnerable and among them, dentists are considered to be at the highest risk [8], although the exact risk is still unknown. SARS-CoV-2 is transmitted by droplets loaded with viral particles emitted from the respiratory tract of an infected individual.

Dentists come in close contact with the oral cavity and are exposed to aerosol from breathing and coughing. Furthermore, droplets land on surfaces and can spread infection in the dental office by direct or indirect contact [9].

Dental care procedures may also aerosolize viral particles from saliva during treatment in the same way as sneezing or coughing. Dental aerosol generating procedures (AGPs) are associated with the use of ultrasonic instruments, air/water syringe and handpieces [10]. They have been charged to be responsible for the virus transmission and infection for healthy patients, but at the same time, they also represent a high risk for the dental health care personnel (DHCP) [11].

AGPs can generate droplets having a diameter ranging from 0.1 μm to 900 μm . Liu Y, et al classified the droplets in five groups, with the largest group ranging from 0.25 μm to 1 μm [12]. The particles with this diameter can reach the alveoli. Droplets < 0.25 μm , loaded with pathogenic microorganisms, can travel up to 20 feet [13], so the 1-2-meter distance advised by WHO is not always enough to prevent cross infection between patients and DHCP.

The minimal aerosol viral load necessary for infection is still unknown; However, in vitro experiments show that aerosol contains viable virus for up to 16 hours [14]. Ineffectiveness of aerosol finds the evidence when COVID-19 gave an outbreak in buses and conference rooms [15]. Treatment sessions on the dentist chair should be divided into two risk categories: with AGP

and without AGP. Each of them must be faced with proper Personal Protective Equipment (PPE) [13]. The Centers for Disease Control and Prevention (CDC) recommended using N95 respirators and not surgical face masks, whenever AGPs are performed [7].

Moreover, if AGP are needed for patients who have or are suspected of having COVID-19, airborne precautions should be strictly followed in addition to adequate PPE and a room with negative pressure, relative to the surrounding area, becomes mandatory [16]. Unfortunately, at this moment, there is still no reliable and efficient test to identify asymptomatic carriers, therefore everybody should be suspected to be infective. Caprioglio et al. published an interesting editorial article on the management of orthodontic emergencies during the initial quarantine period, of COVID-19 pandemics [17].

Recently, the American Dental Association (ADA) has published interim guidelines for minimizing the risk of COVID-19 transmission [18]. There are essential recommendations for all dental practitioners and clearly they should be followed by orthodontists. However, orthodontic treatment is different, since emergency service is seldom required [17], and many orthodontic procedures do not generate AGP.

Moreover, many treatment protocols can be modified to decrease droplets production and thus minimize the risk of cross contamination in the orthodontic office.

The aim of this article is to focus on the orthodontic profession and suggest specific recommendations for care settings, infection control and treatment delivery amid the COVID-19 crisis. The article was written as an international cooperation between the University of Campania Luigi Vanvitelli, Naples, Italy, and the Hebrew University-Hadassah Faculty of Dental Medicine, Jerusalem, Israel.

2. ORTHODONTIC PRACTICE AND COVID-19

2.1. Before orthodontic treatment

- An orthodontic practice usually has a high patient turnover, including a mixture of children and adults. Scheduling of appointments should allow appropriate "social distancing" in the waiting room.

Adults should be instructed to come without companions; however, children are usually accompanied by guardians. In this case, pretreatment triage for signs and symptoms of COVID-19 should be performed for both children and guardians.

DHCP will collect the medical history and check temperature to identify suspect patients until reliable chairside tests for SARS-CoV-2 are developed [19]. Since the virus has been found on shoes, a shoe wrapping machine can be installed at the entrance. Toys, books and other items which may carry the virus have to be removed from the waiting room.

- The recall orthodontic appointments are usually short. Due to the time needed for room cleaning and disinfection, working on a single chair is extremely

inefficient, whereas working on at least 2 chairs, alternating working and disinfection, is preferred. The minimal distance between the chairs is 2 meters and a separation box is needed as a physical barrier to minimize aerosol spreading [20].

- Implementing tele dental applications can be particularly advantageous in this period. Records assessment and proposed treatment plans can be shared virtually online with the patients and discussed using modern web-based communication tools [21]. All communication with patients through virtual tools should be documented in the patients' file for medicolegal protection, as any physical appointment.
- ADA recommended antibacterial mouth rinses (1.5% hydrogen peroxide) before treatment, to reduce the viral load, but there are no clinical studies to support it. Mouth rinses containing β -cyclodextrins combined with flavonoids agents have been proposed for COVID-19 [22]. Children should rinse only under adult supervision.

2.2. During the orthodontic treatment

The CDC divides patient-care items in 3 categories: critical, semi critical, and noncritical, depending on the potential risk for infection. Critical items have the greatest risk for transmitting infection and should always be sterilized using heat [23].

This classification takes in consideration the risk of bloodborne contamination. However, the transmission modes of SARS-CoV-2 are respiratory droplets and physical contact [10]. Under these circumstances, each item that has been in contact with the patient or maybe contaminated by aerosol, becomes critical.

2.2.1. Records collection

- Extraoral radiographs, such as panoramic views, should be preferred whenever possible since intraoral radiographs may cause saliva secretion and coughing [19].
- Clinical photos should be taken wearing clean gloves, masks, and glasses, since cameras are difficult to clean and disinfect. Double gloving allows handling the camera with the inner gloves, after discarding the outer gloves.

Anti-fog treatment of mirrors should be done with warm water and not with air. Assistants should handle the plastic retractor and the mirror, thus four-handed orthodontics is mandatory [24]. The plastic retractor and the mirror should be autoclaved after use. An antibacterial cloth can be used for cleaning the camera surface.

- Dental impressions are potential sources of contamination through the adhered blood or saliva. ADA [19], CDC [24] require impression disinfection to prevent contamination. Irreversible hydrocolloid impressions are effectively treated with 1:10 dilution of sodium hypochlorite for a ten-minute immersion [25]. Disposable impression trays should not be reprocessed since they are manufactured for a single use or for the use of one patient only, and not designed or intended for reuse [26].

• Intraoral scanning should be preferred whenever possible, especially for study models. Scanning does not reduce chair-time, but is more comfortable for the patient, minimizing gag reflex and difficulties in breathing associated with conventional impressions [27]. Moreover, the intraoral tip of the scanner is autoclavable.

2.2.2. Multibracket appliances

- Bonding requires etching of the enamel. Air/water syringe is used to wash and dry the enamel after etching, as well as to spread the bonding resin into a thin layer before light curing. ADA is advocating the use of a rubber dam for AGPs, to help minimize aerosol or splatter, as the saliva is washed away from teeth and aspirated with high power suction, before drying with the air syringe [11].

The use of a rubber dam in orthodontics has been already proposed for bracket bonding in general anesthesia [28] and can be also adopted in the routine orthodontic practice. Conversely, a rubber dam can introduce errors in bracket positioning, which can be avoided by using indirect bonding techniques or drawing marks on the teeth.

- Self-etching primer, which eliminates the need for air/water spray washing and drying, is an excellent alternative to the two-step conventional bonding techniques.

The bond strength with self-etching primers is clinically acceptable and bonding duration is also slightly reduced [29].

- Indirect bonding is an additional option which can significantly shorten chair-time, by up to 30 min for both arches [30] and reduce the DHCP exposure.

Thus, a combination of self-etching primer and indirect bonding significantly decreases the risk of aerosol contamination during bonding procedures.

- Visible-light curing units are a potential source of transmission due to contamination of the light curing tip, which directly contacts oral structures, and the handle, which becomes contaminated with blood and saliva from the DHCP gloves.

Different infection control techniques, that meet the CDC-recommended standards, include sterilization of curing tips, disposable barriers, or single-use plastic wrapping tip [31].

2.2.3. Removable appliances

Managing removable appliances in the clinic creates a low risk for the transmission of SARS-CoV-2 [17]. Impressions for appliances should be delivered to the lab after proper disinfection [see above] and returned from the lab after ultraviolet (UV) sterilization [32] in a plastic bag sealed with a label.

2.2.4. Other orthodontic procedures

Inserting, tying, and removing archwires and/or mini-screws are not AGPs and may be performed with the conventional ADA interim precautions [18].

2.2.5. Aligners

Compared with fixed appliances, aligners offer the advantage of shorter chair-time and fewer overall appointments in the office, therefore decreasing the

risk for airborne transmission. Whenever possible, treatment progress can be assessed, and further instructions can be given through online virtual meetings. Attachments can be bonded with the aid of self-etching primers similarly to bracket bonding [33] and refined manually. On the contrary, attachment removal, like bracket debonding, is riskless only if a rubber dam is utilized.

2.2.6. Interproximal enamel reduction

Instruments used to slenderize teeth usually include diamond disks or air rotor burs [34,35]. These methods inevitable create aerosol.

Manual interproximal enamel reduction with hand-operated abrasive strips is more time consuming and harder to use in posterior teeth, however it creates less aerosol and should be preferred in this period. Strip holders may aid in manual interproximal reduction [36].

2.2.7. Auxiliaries

Elastomeric ligatures, coils or other auxiliaries can be cut in small pieces, inserted in pouches before treatment and delivered to the doctor by the dental assistant. However, in case they are mistakenly contaminated, the unused parts can be sterilized via cold sterilization. Disinfection of these materials in a 2% glutaraldehyde solution for 10 minutes has no effect on strength and distention [38].

2.2.8. Band application and removal

No particular restriction is advised for these procedures, except for the use of air/water syringe. If used and tried on in the mouth, bands should be sterilized in autoclave. When bands are removed, cement breaks away and there is no need to use a handpiece.

2.3. End of orthodontic treatment

2.3.1. Bracket debonding

Debonding and enamel cleanup is the orthodontic procedure which produces the highest amount of aerosol and splatters [39]. Usually, brackets are debonded with special task pliers, but the adhesive remnants are removed with high speed or low speed burs, discs, or ultrasonic scalers [40]. Dental dam can prevent aerosol creation [10]. Remnants of bonding material can also be removed manually, using adhesive removing pliers, although this method is more time consuming and less efficient, leaving more adhesive remnants on the teeth [41]. The use of ceramic brackets should be restrained for their frequent fracture during debonding and the consequent need to use a turbine handpiece.

2.3.2. Retainers

Previous articles reported the bonding of retainers with a rubber dam in order to prevent failures [42]. During the current period, the rubber dam is even more recommended. Self-etching primers and indirect bonding [43] can further shorten chair-time and lower the risk of aerosol exposure, as explained above. Alternatively, clear retainers can be performed using intraoral scans and fixed retainer bonding postponed at this stage.

3. STERILIZATION OF ORTHODONTIC PLIERS

Orthodontic pliers touch patients' mucosa/skin and therefore become critical items in the COVID-19 era, and must be sterilized by autoclave. Pliers should be maintained in sterile envelopes, opened just before their use.

A larger supply of instruments is thus mandatory and if a plier is heat-sensitive, it should be replaced by a heat-tolerant item. On the other hand, heat sterilization leads to less corrosion than cold disinfection [37].

4. CONCLUSIONS

Similarly to other dental professions, orthodontists are at a very-high-risk for COVID-19 infection, and all published guidelines should be followed for the patient's and DHCP's safety. In the past, DHCP protection measures mostly addressed bloodborne infections. Presently, protection from COVID-19, which is highly transmissible through aerosol, droplets, and contact, is the main global concern.

In this period, the care settings, the infection protocols, and the delivery of AGP clinical procedures must be revised and modified to overcome the threat of SARS-CoV-2 infection in the orthodontic practice.

List of abbreviations

COVID-19 - Coronavirus disease 2019
 (SARS-CoV-2) - Severe Acute Respiratory Syndrome Coronavirus 2
 SARS-CoV - Severe Acute Respiratory Syndrome Coronavirus
 MERS-CoV - Middle East Respiratory Syndrome Related Coronavirus
 ACE2 - angiotensin-converting enzyme 2
 WHO - World Health Organization
 AGP - dental aerosol generating procedure
 DHCP - dental health care personnel
 PPE - Personal Protective Equipment
 CDC - Centers for Disease Control and Prevention
 ADA - American Dental Association
 UV - ultraviolet

Declarations

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

LP, SC and GC conceived the protocol, wrote, and revised the manuscript. LN, RC and OY revised the literature and collected the references.

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Letizia PERILLO

MD, MS, PhD, Professor, Head, Dean
 Multidisciplinary Department of Medical-Surgical and Dental Specialties
 School of Dentistry
 University of Campania Luigi Vanvitelli
 Naples, Italy



CV

Letizia Perillo is full Professor and Dean of the School of Dentistry, University of Campania Luigi Vanvitelli, Naples (Italy). She is Visiting Professor at the University of Alabama (USA) and of Alexandria (Egypt). She was elected President of the Italian Society of Orthodontics (2021), of the Mediterranean Orthodontic Integration Project (2022), and International Ambassador of the American Association of Orthodontists (2018-2020). She is a member of many international dental organizations and of the Editorial Board of several journals. She graduated in Medicine and Surgery and specialized in Orthodontics at the University of Naples Federico II. She completed a postgraduate fellowship at the University of Michigan and a PhD in Interceptive Orthodontics at the University of Florence. She is authored several publications and she is speaker at international courses and congresses.

Questions

1. Dental aerosol generating procedures (AGPs) are associated with:

- a. The use of ultrasonic instruments;
- b. Air/water syringe;
- c. Handpieces;
- d. All of them.

2. When was Covid-19 declared a pandemic by the World Health Organization (WHO)?

- a. On January 31th, 2020;
- b. On February 11th, 2020;
- c. On March 11th, 2020;
- d. On April 12th, 2020.

3. Which dilution of sodium hypochlorite is effective for the disinfection of irreversible hydrocolloid impressions?

- a. 1:10;
- b. 2:10;
- c. 3:10;
- d. 4:10.

4. Which is the diameter of particles that can reach the alveoli?

- a. From 0.1 μm to 1 μm ;
- b. From 1 μm to 10 μm ;
- c. From 10 μm to 100 μm ;
- d. >100 μm .



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PRESIDENT ELECT ERO-FDI



Dr. Anna Lella
PAST PRESIDENT ERO-FDI



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