

Review Article

A to Z Steps of In-person Screening, Treatment, and Caring Procedure in Orthodontic Clinics During COVID-19 Pandemic: A Rapid Mini-review



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ABSTRACT

Background: A novel coronavirus emerged from Wuhan, China, in December 2019. Dental healthcare providers are at the highest risk of exposure since the primary source of the virus is saliva, and dentists are the front-line personnel working with the oral cavity. Since orthodontic treatment is a long-term procedure for children and teenagers, and because of the critical gap in preparing a specific guideline on orthodontic treatment procedures, orthodontic practitioners have faced numerous complicated issues in this regard. This mini-review aimed to summarize the facts that the orthodontic settings should be aware of the dental difficulties during COVID-19 with a particular focus on orthodontic treatment.

Methods: In this short review, electronic databases of Medline, Scopus, Web of Science, and Google Scholar were searched for relevant articles and guidelines from January 2019 to March 2021 using the following key terms: "COVID-19," "SARS-CoV-2," "Pandemic," "Orthodontics," and "Orthodontists."

Results: Gathering recommendations of experts and several guidelines led to the following crucial steps in orthodontic procedures: screening through a telehealth questionnaire; admitting just patients into the dental center; ventilating the waiting room; measuring the temperature of patients' bodies; disinfecting the dental unit and instruments after each visit; using personal protective equipment; washing hands; minimizing the use of high-speed handpieces to reduce the aerosol generation; and sterilization of archwires, orthodontic markers, photographic retractors, molar bands, burs, miniscrews, and unit waterline with proper methods.

Conclusions: All dentists should be up-to-date on cross-transmission of SARS-CoV-2 and follow the international infection control protocols as well as national/provincial/local guidelines and apply them to the regional settings after generalization and matching with the condition.

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1. Context

At the end of 2019, a novel coronavirus emerged from Wuhan, China. The respiratory syndrome coronavirus 2 (SARS-CoV-2) spread throughout the world very fast and was declared a pandemic by the World Health Organization (WHO) on March 26, 2020 (1). According to WHO Coronavirus Disease 2019 (COVID-19) dashboard, this novel virus has been responsible for approximately 10321689 infections, including 507435 deaths as of 10:56 AM CEST, July 1, 2020.

Because of the virus' widespread transmission, health-care personnel are at a high risk of catching the virus and transmitting it. Among medical community staff, Dental Healthcare Providers (DHCP) are at the highest risk of exposure since the primary source of virus spread is saliva, and dentists are the front-line personnel working with the oral cavity (2, 3).

Since orthodontic treatment is an ongoing and lengthy process, many patients, such as children and teenagers, should undergo orthodontic treatment before the cessation of non-urgent dental procedures (4). However, because of the no specific guidelines on orthodontic treatments, orthodontic practitioners have faced numerous complicated issues in this regard. Hence, this short review summarizes the facts that the DHCP should be aware of the dental difficulties during the COVID-19 pandemic with a particular focus on orthodontic treatment.

2. Evidence Acquisition

In this short review, electronic databases of Medline, Scopus, Web of Science, and Google Scholar were searched for relevant articles and guidelines on the challenges and processes of dental and orthodontic treatment during the COVID-19 pandemic. Two of the authors conducted the search using the following key terms of "COVID-19," "SARS-CoV-2," "Pandemic," "Orthodontics," and "Orthodontists," from January 2019 to March 2021. After removing the duplicates, titles and abstracts of articles were screened according to the inclusion and exclusion criteria. Articles arguing the procedure of dental treatment and challenges through other pandemics were excluded. Then, two authors carried out the full-text screening separately, and another author resolved the disagreements.

3. Results

Virology, immunology, and pathogenicity of SARS-CoV-2

Coronaviruses are enveloped positive-sense, single-stranded RNA viruses comprising four types of α , β , γ , and δ , of which the SARS-CoV-2 belongs to type β , similar to MERS-CoV and SARS-CoV (5). The virus life cycle begins through binding to the angiotensin-converting enzyme 2 (ACE2) by its spike glycoprotein to infect the host cell (6, 7). After the entrance, the antigen presentation cells (APCs), known as the main antiviral immunity, stimulate humoral and cellular immunity by interacting with the virus antigens (8, 9).

As humoral responses in mild COVID-19 patients, type I interferon antiviral response and considerably dropping levels of CD4+Th1 and CD8+T-cells are observed in the peripheral blood of such patients (10). In critically ill patients, after a delay in responding, an unexpected increase of inflammatory cytokines following monocytes and neutrophils recruitment into the lungs, leading to cytokine storm syndrome, vascular permeability, and finally, respiratory failure, are observed (11).

However, the understanding of COVID-19 pathogenicity relies on the conception of the virus antigens interactions and demonstrations. Though there is still no sufficient evidence in this regard, we have to rely on the evidence of other well-studied coronavirus types (e.g., SARS-CoV and MERS-CoV).

Clinical symptoms

The COVID-19 disease usually presents with symptoms of fever, dry cough, myalgia, and fatigue. Less common reported symptoms are headache, nausea, diarrhea, hyposmia, dysgeusia, expectoration, and hemoptysis (12, 13). Another usual manifestation is pneumonia, in which chest X-ray and computed tomographic scan indicate abnormal findings such as small patchy nodular shadows and ground-glass opacities (13). COVID-19 has different clinical presentations in children. Most symptomatic children with suspicion of COVID-19 have a fever and respiratory symptoms (14).

Nearly 80% of such COVID-19 patients are asymptomatic or only present mild flu-like symptoms. Therefore, such asymptomatic cases are carriers of the SARS-CoV-2, which is highly transmissible due to the virus's long incubation period (0-24 days) (13, 15). The severity of the illness is higher in older age males with underlying disorders such as cardiovascular diseases and immunosuppression,

which lead to acute respiratory distress syndrome (ARDS), acute cardiac and kidney injury, and death (16).

Transmission

Regardless of the primary transmission from animal to human, right now, the primary source of SARS-CoV-2 transmission is symptomatic or asymptomatic COVID-19 individuals (16). According to WHO, droplets or contact directions (<1 m) in case of sneezing, coughing, and talking loudly are the main routes of person-to-person transmission (17). This characteristic mandates social distancing to minimize the infection spread among communities. Also, the landing of SARS-CoV-2 droplets on various objects close to the patients is another possible way of transmission through touching contaminated objects (18). Hence, according to people's face touching habit (23 times/h) (19), handwashing, and object disinfection are crucial in infection control.

In dental systems, the patient's treatment procedures include tools such as high-speed handpieces, mouth mirrors, saliva ejectors, etc., which are potential ways for aerosolization of saliva and blood into the office setting and on the objects. Hence, the virus can be transmitted to new cases without direct contact with the infected patients (20, 21). In such situations, conventional standard approaches for infection control in regular clinical systems would not be valid and appropriate for preventing SARS-CoV-2 transmission, especially in the incubation period or concealing cases (22).

Management

Based on guidelines of WHO and the Centers for Disease Control and Prevention (23, 24), when there is no specific treatment approach, COVID-19 cases management includes transmission prevention, supportive care (e.g., ventilation, usual therapies for preventing complications, etc.), self-isolation, and hospital-isolation in critically ill patients following respiratory assistance.

Dental system

To prevent the SARS-CoV-2 infection, dental health-care providers need to keep updated with new studies and guidelines on prevention and treatment protocols related to dental setups.

Pointing at the importance of dental concerns, Huaqiu Guo et al. investigated "the impact of the COVID-19 epidemic on the utilization of emergency dental services." This study demonstrated that 38% fewer dental pa-

tients' referrals to the dentistry centers at the beginning of the COVID-19 pandemic compared to the past, with a substantial alteration in the types of dental complaints. The rate of oral/dental infections increased from 51% to 71.9%, dental traumas reduced from 14.2% to 10.5%, and elective procedures decreased by 70%. The most prevalent emergency cases were suffering from dental pulp, periapical lesions, cellulitis, and abscess. Hence, evidence indicates that dental setup emergencies are under the COVID-19 pandemic effect, and ample attention should be considered.

Also, a survey of 3599 dentists regarding the COVID-19 Outbreak in North Italy, conducted by Cagetti et al. (25), revealed a high percentage of symptoms presentation in dentists (14.43%), of which only 31 cases were positive for the COVID-19. Cautious of dentists on COVID-19 management was substantially higher in those dentists working in areas with the highest prevalence. Regardless of higher exposure risk and more symptom presentations, such dentists in COVID-19 prevalent areas were more confident in preventing the SARS-CoV-2 infection. In the case of education, only one-third of the dentists have followed COVID-19 continuous educational courses.

Moreover, in Consolo et al.'s study on psychological reactions of dentists to COVID-19, nearly 85% of them expressed their concern about contracting the infection during clinical activities. This highly negative impact was followed by an emotional state of concern (70.2%), anxiety (46.4%), and fear (42.4%). All these matters resulted in deep concerns regarding future performance and economic issues in 89.6% of dental practitioners.

In this complicated and stressful situation, the problem is many times greater in orthodontic treatments due to a long-term ongoing procedure, which needs continuous monitoring. Unexpected and long restrictions, as well as postpone of elective cases, have produced considerable growth in orthodontic patients, which would lead to many difficulties in social distancing and infection prevention. Moreover, regardless of any reports on SARS-CoV-2 cross-transmission within dental systems, there is still a high risk of transmission in such communities since the research data are unreliable. Also, according to other cross-transmissible infections within dental settings, such as hepatitis B and hepatitis C, orthodontists are in the second rank of the hepatitis B infection acquired community (26-28).

In more detail, orthodontic materials and instruments are highly prone to cross-contaminations. Regarding archwires, while there are packed and sealed, there are

orthodontists who recycle the wires, which substantially increases the transmission risk in case of not sufficiently sterilization (29-31). Recycling other orthodontic tools, such as orthodontic brackets, bands, markers, miniscrews, etc., could highly increase the risk of cross-transmission if the disinfection process is not proper (32-34). Moreover, instruments that are directly in contact with blood and saliva, band seaters, band removers, periodontal scalers, and tucking ligatures are significantly dangerous as well (35). Inappropriate management and sterilization of such materials and tools would endanger infection handling in the orthodontic treatment procedures. Hence, concerning what was mentioned, considerable attention is needed for a practical, helpful guideline specialized at least for orthodontic treatment procedures.

Preventive procedures in orthodontic settings

To manage the current situation, gathering recommendations from experts and several guidelines led to the following crucial steps in orthodontic procedures.

Screening through telehealth questionnaire

To identify suspected patients infected with SARS-CoV-2, remotely screening through a telehealth questionnaire scheduling time would be the best choice. The questionnaire should have the following questions:

- A. History of travel to highly contaminated places.
- B. Contacting anyone who has been infected in the family, workplace, community, etc.
- C. Manifesting common COVID-19 symptoms such as fever, cough, fatigue, breathing difficulty, etc.

In case of positive answers and probability of infection risk, the best choice would be to postpone the appointment, especially in elective cases, for at least 14 days of self-quarantine (36). The orthodontist visit is not possible for confirmed COVID-19 individuals who manifested acute symptoms and referring to the COVID-19 referral centers is mandatory before an orthodontic appointment (37).

A to Z of In-person screening, treatment, and caring procedure (36, 38)

A. If possible, only the patient should be allowed to enter the dental center. In urgent cases, only one low-risk person for COVID-19 can accompany the patient (20, 39).

B. Patients and their accompanies must wear masks and use an alcohol-based hand rub (ABHR) before entering the dental setting (39).

C. Patients should be seated in a well-ventilated waiting room in a social distancing manner, based on international guidelines (6 feet, 182 cm) (40).

D. Patients have to fill out a questionnaire regarding medical history and COVID-19 symptoms (40).

E. Magazines or entertainment tools must be removed from the waiting room to prevent the people's contact and cross-transmission (40).

F. An orthodontist or assistant should measure the patient's body temperature with infrared cameras or a forehead thermometer. Individuals with a temperature over 38°C or any common COVID-19 symptoms have to be postponed, especially in elective cases (39).

G. The dental unit and instruments should be disinfected after each visit using surface sanitizers such as 70% ethanol alcohol, 0.5% hydrogen peroxide, and 0.1% sodium hypochlorite due to the stability of the virus on the surfaces (41).

H. Pre-procedural mouth rinse with 1% hydrogen peroxide or 0.2% povidone-iodine is highly recommended (37).

I. Using personal protective equipment (PPE), such as gowns, face masks, shields, glasses, gloves, etc., is critical and mandatory during the COVID-19 pandemic (22, 38).

J. According to the investigations, the SARS-CoV-2 is also transmissible through the ocular mucous membrane, and contact with eye mucosal tissues is critical in addition to mouth and nose (22, 42).

K. Because of the potency of SARS-CoV-2 airborne transmission, filtering facepieces such as FFP2, FFP3, N95, etc., in addition to PPEs, would be significantly beneficial (38, 43, 44).

L. Hand hygiene has to be considered based on WHO protocols through washing hands with water and soap or ABHR (37, 45).

M. Yellow anti-leakage medical waste bags have to be used for medical wastes (46, 47).

N. To prevent the reflexes (e.g., cough, gag, etc.) during intraoral imaging, extra-oral imaging is recommended. In the case of essential intraoral imaging, double-

covering of sensors is critical for cross-transmission prevention (48).

O. To prevent virus spread, local anesthesia gels are preferred to anesthetic sprays (49).

P. It is of value to apply a single-use approach to the potential cross-contamination tools such as dentist's mirrors, syringes, etc.

Q. To avoid aerosol generation, it is recommended to use manual scaling and polishing approach for plaque and calculus elimination and minimize the use of high-speed handpieces and three-way syringes.

R. Orthodontic instruments such as pliers, tweezers, cutters, etc., must be disinfected and sterilized through steam sterilization, ultrasonic cleaner, thermal disinfection, or chemical sensitizers, such as 2% glutaraldehyde or 0.25% peracetic acid (50, 51).

S. The preferred approach for sterilizing archwires is the autoclave, with no adverse effect on wires (29, 30, 52).

T. The best choice for sterilizing orthodontic markers is steam sterilization or 2% glutaraldehyde (53).

U. For photographic retractors disinfection, the washer-disinfector showed the most promising outcomes (54).

V. Tried-in orthodontic molar bands are recommended to use after adequate disinfection (55, 56).

W. For sterilizing tungsten carbide burs, the autoclave is the most promising method (57).

X. Miniscrews and elastomeric chains have to be disinfected. In case of concerns regarding their mechanical properties loss, studies indicated that sterilization methods do not affect the matter significantly (32, 58).

Y. Disinfection of the unit waterline with Alpron or Sterilox is recommended to decrease the risk of cross-transmission (59).

Z. DHCP self-appraisal is recommended in the case of symptoms manifestation to prevent the infection spread (44).

4. Conclusion

SARS-CoV-2 is highly transmissible and affects people's lifestyles globally. Although there is no special report on cross-transmission of SARS-CoV-2 in dental settings, all

dentists should be up-to-date on the matter and follow the international infection control protocols and national/provincial/local guidelines and apply them to the regional settings after generalization and matching with the condition. This review summarizes the latest knowledge of dental settings during the COVID-19 pandemic with a particular focus on orthodontic settings. It is recommended to suspend the elective routine orthodontic treatments and follow the "A to Z in-person screening, treatment, and caring procedure" in emergency cases.

Ethical Considerations

Compliance with ethical guidelines

There were no ethical considerations to be considered in this research.

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Authors' contributions

All authors equally contributed to preparing this article.

Conflicts of interest

The authors declared no conflict of interest.

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