TURKISH JOURNAL of ORTHODONTICS

DOI: 10.5152/TurkJOrthod.2021.20057

Review

Coronavirus Disease 2019- Challenges Today and Tomorrow in Orthodontic Practice: A Review

Rony Tomy Kondody, Safiya Sana, Rekha Reddy, Asma Fatima, Sayeeda Laeque Bangi

Department of Orthodontics & Dentofacial Orthopaedics, Al-Badar Rural Dental College & Hospital, Gulbarga, India

Cite this article as: Kondody RT, Sana S, Reddy R, Fatima A, Bangi SL. Coronavirus Disease 2019- Challenges Today and Tomorrow in Orthodontic Practice: A Review. Turk J Orthod 2021; 34(1): 61-7.

Main points:

- As uncertainty about the coronavirus disease 2019 (COVID-19) pandemic increases, it is necessary to have clear guidelines or rules that explain which emergencies orthodontists must attend to and which they can defer.
- There are many situations where an orthodontist cannot leave the patients unattended for more than 6 to 10 weeks..
- Guidelines for COVID-19 testing, the type of personal protective equipment are required in orthodontic practice.
- Creation of guidelines for obtaining consent and proper documentation are also of utmost importance when contacting patients remotely.

ABSTRACT

From the start of 2020, the world has witnessed the biggest health and humanitarian crisis in the modern century named coronavirus disease 2019. The rapid spread of infection created chaos and confusion across the globe. Like all other health professions, a timely and major reorganization of orthodontic services is challenging. Unlike other medical emergencies, an orthodontic emergency does not require immediate attention in most cases. With advances in the modern web-based communication systems, minor problems can be managed online in orthodontic practice. During an emergency, however, orthodontists have a moral obligation to treat and manage patients under the World Health Organization guidelines and protocol.

Keywords: Coronavirus, orthodontic practice, web-based communication

INTRODUCTION

The outbreak of coronavirus disease 2019 (COVID-19) has been declared as a global health crisis by the World Health Organization (WHO), and it has led to major disruptions, national emergencies, and lockdowns, leaving only the essential services to continue. The human spread of the infection is majorly through the respiratory secretions and droplets and/or direct contact by which the virus enters the mucous membranes of oral and other associated structures (1). The origin of the pneumonia-like infection of unknown causes is believed to be from bats, and the infection was first detected in the city of Wuhan in Hubei province, China (2). COVID-19 infections are caused by a variant of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which belongs to the family Coronaviridae. Other rare strains, such as Middle East respiratory syndrome coronavirus (MERS-CoV) and severe acute respiratory syndrome coronavirus (SARS-CoV) belonging to the same family, are responsible for Middle East respiratory syndrome and severe acute respiratory syndrome (SARS) diseases, respectively (3).

The degree of infection spread is high in orthodontic practice because of the characteristics of orthodontic clinics and nature of treatment. To control and reduce the transmission of coronavirus infection, it is essential to follow standard infection control guidelines and protocols and strict behavioral guidelines in addition to the correct use of personal protective equipment (PPE) (4).

Before any urgent dental care, patients who are potential carriers of the infection should be detected to prevent further spread of infection. Emergency treatment needed for a patient may be categorized on the basis of

Address for Correspondence: Rony Tomy Kondody, Department of Orthodontics & Dentofacial Orthopaedics, Al-Badar Rural Dental College & Hospital, Gulbarga, India
E-mail: ronykondody55@gmail.com

Received: April 28, 2020
Accepted: October 12, 2020

whether the procedure generates aerosols. During this COVID-19 period, it is better to reduce the aerosol-generating procedures (AGPs), whenever possible, because these aerosols carry a high risk of infection. Questionnaires can be used to identify high-risk groups depending on medical history and systemic conditions. Furthermore, body temperature should be measured before attempting any clinical procedure (5).

Owing to the rapidly evolving nature of the infection, orthodontists, like all other health professionals, are struggling to balance the safety of orthodontic team in their commitment to their patients. Therefore, concise protocols and safety measures are needed for managing various orthodontic emergencies (6). When dealing with a pandemic, appropriate time management and circumstance-specific protocols are the only options available to maintain the efficiency of appliances (7).

This review aimed to provide a comprehensive and detailed summary of problems faced in the field of orthodontics and to discuss the need for guidelines and protocols in the handling of various emergency orthodontic procedures.

Epidemiologic Characteristics

COVID-19 remains a highly infectious disease with a reproductive number (R0) of approximately 1.4 to 2.5 according to the WHO estimate (8). Preliminary studies conducted at the beginning of the outbreak have reported higher estimates of R0 of infection in the range of 2.24 to 3.58 (9). All the estimates of transmissibility indicate that self-sustaining progression between humans is the main reason for the magnitude of this outbreak (10, 11).

The incubation period for COVID-19 remains comparable with that of other recent epidemic viral diseases, such as SARS (2-7 days) (12) and MERS-CoV (2-14 days) (13), but it is slightly longer than that of swine flu (1-4 days) and seasonal influenza (1-4 days) (14). A recent study looking at 88 cases of travel-related infection spread has shown an average period of incubation of approximately 6.4 days (2.1-11.1 days) (15).

Clinical Signs and Symptoms

Clinical manifestations of this disease range from mild to severe illness along with other clinical conditions, such as pneumonia, acute respiratory distress syndrome (ARDS), sepsis, and multiorgan failures (16). Various signs and symptoms include fever, cough, sore throat, nasal congestion, malaise, and headache, whereas atypical symptoms can be seen in immunocompromised patients (17-21). In serious illness, it is likely to see symptoms, such as pharyngeal pain, dyspnea, dizziness, abdominal pain, and anorexia (18). In older individuals, adverse outcomes can be associated with underlying comorbidities such as diabetes, cardiovascular disease, and cerebrovascular disease (20).

The onset of ARDS is associated with severe shortness of breath that might develop within a few hours to a few days after the infection (16, 22). Significant decrease in CD4 and CD8 levels can be seen in the initial stages of infection, and chest imaging can show bilateral opacities, lobar or lung collapse, or nodules (20).

Diagnosis of Coronavirus Disease 2019

The WHO recommends that culturing of the virus must be performed in a biosafety level (BSL)-3 laboratory and the reverse transcription-polymerase chain reaction (RT-PCR) be performed in a BSL-2 laboratory (24, 25). When handling specimens of SARS-CoV-2, one must ensure that the sample is not contaminated or the healthcare worker (HCW) is not infected to minimize any risks and to ensure accuracy of diagnosis. Isolation of SARS-CoV-2 can be performed using cell lines, and diagnosis has to be confirmed by RT-PCR.

Seroconversion for the disease is evaluated by the detection of antibodies in convalescent-phase serum after a negative result in the acute-phase serum sample. Seroconversion can be confirmed by enzyme-linked immunosorbent assay or indirect fluorescent antibody test (26).

Tele-Triage and Pre-Appointment Screening

Triage should be established so that teleconsultation or web-based communication with the patient will assist the patient in resolving any urgent orthodontic problems that can be managed at home and to determine the need for a patient's visit to the orthodontic office or provide support by following the social distancing protocol. The triage team should inform patients about the preventive measures to be undertaken, such as maintaining social distance, wearing masks, washing hands, or using hand sanitizer, that must be followed in a healthcare facility.

Triage screening or self-assessment tools published by the Centers for Disease Control and Prevention (CDC) and Mayo Clinic include questions about recording a patient's body temperature, updating the patient's medical history, and asking targeted questions mandatorily (27, 28).

1. History of fever (37.3°C or higher) or use of antipyretic medications in the past 14 days?

2. Have you traveled to a country/area reporting high transmission of COVID-19 infection?

3. History of contact with COVID-19-positive patients in the past 14 days?

4. Have you recently participated in a large gathering?

5. Symptoms of any lower respiratory tract infections, such as difficulty in breathing, shortness of breath, sore throat, cough, diarrhea, or loss of smell or taste?

If patients answer yes to any of these questions, advise them to self-quarantine at home for 14 days.

For patients with a history of COVID-19 infection, any orthodontic emergencies should not be performed unless the patient has followed the CDC guidelines listed below:

1. At least 72 hours have passed since recovery (resolution of fever without the use of antipyretics and no respiratory symptoms, such as cough, shortness of breath, and difficulty in breathing).

2. One week has passed since the initial symptoms.

3. The patient should have 2 negative laboratory test results in 24 hours at least.

The orthodontist must perform the necessary measures to resolve the emergency and advice the patient to maintain optimal oral hygiene, follow a low-sugar diet, and avoid hard and sticky food that can lead to breakage of appliance.

After tele-triage, when a patient needs to be examined clinically, the triage team should ask the abovementioned screening questions (screening questions with informed consent and necessary documentation). The patient should be advised to enter the office with maximum 1 accompanying person who should not be medically compromised (29). Instruct the patient to enter the operatory room alone wearing a mask, and the accompanying person should remain in the waiting room or parking lot.

Infection Control and Management of Orthodontic Practice

Preventive Measures

The orthodontic office must maintain very high standards of infection control procedures and sterilization of instruments. The orthodontist/clinician should examine the patient by wearing PPE, which includes a face mask (fit-tested N95 masks), double gloves, eye protection, face shield, and gowns (29, 30).

Because the level of infection in human saliva is high, it is necessary to use preprocedural mouth-rinse, such as hydrogen peroxide (1%) or povidone-iodine (0.2%), to reduce the salivary load of microbial flora, because the SARS-CoV-2 is vulnerable to oxidation (4, 5). The Faculty of General Dental Practice guidelines recommends that there is no evidence of a virucidal effect.

The orthodontic team should be trained about the disease symptoms, mode of transmission of disease, and infection control procedure, such as thoroughly disinfecting all surfaces with 0.1% to 0.2% of sodium hypochlorite for 1 minute or 62% to 95% ethanol for disinfection of small surfaces (31). Medical waste should be presumed to be infectious and disposed off as infected medical waste. HCWs should be taught proper donning and doffing of PPE (29, 31).

In the operatory area, adequate ventilation with fresh air or high airflow is advised. It is necessary to have a private room or negatively pressured rooms for treating patients who may be infected. The distance between the dental units must be a minimum of 2 m if this room is not available. The room should be reorganized in a way that patients can maintain a safe distance when entering or leaving the clinic. The disinfection protocol should be repeated after each patient consultation (5). All dental staff and patients/carers should disinfect their hands when entering and leaving the room. This must be performed immediately before every episode of direct patient care. Disposable tissues and materials should be made available to the patients to cover their nose and mouth in case of coughing (32). The dental unit waterline should be flushed for at least 2 minutes using disinfectant to not only minimize the risk of infection but also improve the quality of water. Orthodontic pliers should be sterilized with steam autoclave, ultrasonic bath, and cold sterilization with 2% of glutaraldehyde or 0.25% of peracetic acid solution. Photographic retractors, debonding burs should be decontaminated with washer-disinfector (29).

Owing to the unprecedented and evolving nature of the disease, current guidelines advise limiting the use of AGPs to reduce the chance of cross-infection (4). Aerosols could be contaminated with the patient's saliva or blood and increase the concentration of microbial flora, exceeding those produced by sneezing or coughing. They may spread as far as 2 m from the patient's mouth, which could contaminate the entire operatory area.

The various AGPs include (33-37):
- high-speed air rotor or low-speed drills, including surgical drills
- three-in-one air/water syringes
- ultrasonic and sonic handpieces
- air abrasion procedures or intraoral sandblasting.

Preventive Measures to Minimize the Effect of Aerosol Production in the Orthodontic Office

Aerosol production in the orthodontic office is basically through 2 routes: bonding and debonding procedures. For orthodontic practice, this extrapolates for procedures that use slow rotary instruments or air turbine with high speed, three-in-one air/water syringe, and enamel preparation using ultrasonic or air abrasion devices. This will have a direct impact on adhesive removal from enamel and the use of air/water sprays and rotary handpieces for moisture control and cleaning. A recent study by van Doremalen et al. (38) has indicated that coronavirus can survive from 4 to 24 hours on copper and paper surfaces, whereas infectious charge is reduced only after 48 hours on a steel surface and 72 hours on plastic material.

Bonding Procedure

Aerosol production with bonding procedures involves the use of water-spray in enamel etching, increasing the likelihood of spatter and droplet formation and resulting in increased working time. Liquid gel/low-viscosity and self-etching primer should be prioritized over conventional acid etching. Light-cured resin-modified glass ionomer cement is also preferred over conventional light-cured bonding agent although it has compromised bond strength (39, 40).

Debonding Procedure

During the debonding procedure, preventive measures to minimize aerosol contamination of the operatory area should focus on minimizing the composite remnants after bracket debonding and effective grinding patterns to reduce dust, operating time, and particulate generation. Cohesive resin fracture would allow for minimal enamel remnants by identifying bracket base mesh, size, and shape with adhesive composition. One can avoid rotary instruments and reinforce the use of hand instruments for removal of resin remnants. Using tungsten carbide burs without water for removal of limited traces of resin remnants can be recommended (41).

Table 1. Various orthodontic emergency scenarios, home care, and emergency precautions

Orthodontic emergency	Home care/emergency procedure
Sharp protruding distal wire	• A cotton bud or pencil eraser can be used to flatten the wire against the tooth surface to prevent impingement. • A clean or sterile tweezer can be used to grip the wire so that it can be secured to both sides comfortably. • Relief wax can be used to prevent irritation. • A sterile or clean nail clipper can be used to remove the protruding part of the wire.
Debonded bracket	• Self-etching primer can be used, which minimizes treatment time and the amount of moisture.
Impingement from ligature wire	• If ligature wire is loose, a tweezer can be used to remove it. • Relief wax or cotton swab can be used to prevent irritation.
Irritation from the broken fixed retainer	• If part of the retainer is broken, it can be removed with the help of a clean clipper. • If the entire retainer is loose, the patient should be advised to remove it carefully with help of a tweezer and use a removable retainer (if provided). • If retention is necessary for stability, the patient should be advised to visit the orthodontic office under strict healthcare protocol.
Severe pain and/or infection from orthodontic bands or appliance embedded into the gingiva	• This requires immediate attention, which should be managed in an orthodontic setup. The patient should be cleared of all tele-triage screening. • If the patient cannot be attended to in-person, the part which is impinging or embedded within the gingiva should be removed carefully with a clipper. • The patient can be advised to use mouthwash and saltwater gargle. • Antibiotics and antipyretics can be prescribed with a digital signature by the orthodontist.
Loose removable appliance	• It can be removed or discontinued until the next visit with the orthodontist, when the clinic/practice reopens for a routine procedure. • If it is necessary for stability, the orthodontist can deliver a new set of removable appliances such as removable quad helix, if necessary.
Broken or ill-fitting aligner	• If the current aligner is broken or ill-fitting, switch to the previous aligner. If the previous aligner is also ill-fitting, have a new aligner, if possible.
Broken or loose palatal expander or transpalatal arch	• If these appliances are partially glued on, they can be placed back in position, and any screw activations should be stopped. • If it has fallen out completely, it should be kept in a safe place until further instructions from the orthodontist.
Laceration or ulcers from a broken appliance	• Mouth sores can be relieved by applying topical anesthetics, egora-bases, or dentogel.
Swallowed bracket/piece of appliance	• If swallowed, the patient should be asked about difficulty in breathing or sudden coughing. In case of severe difficulty, the patient should be admitted to the hospital as an emergency. • If no difficulty is experienced, it may pass through the digestive tract without any complication.

Use of high-volume suction in orthodontic practice has been shown to reduce a significant amount of aerosols in the environment and should be employed in all AGPs, including trimming appliances outside the oral cavity. A rubber dam can be also used to reduce the biodiversity of aerosols when multiple teeth are being treated, although practical implications in orthodontics are limited. Another alternative for the clinician would be to schedule appointments for different times or even separate days when AGPs need to be performed. A separate unit can be used for AGPs.

Filtering facepiece class 3 respirator also offers a useful method of filtration of particles as small as 0.6 μm and can be used to reduce aerosol particles in the environment (32). Furthermore, when treating any patient, it is imperative to use PPE, such as face shields and goggles, and the abovementioned common preventive measures should be followed (42).

Orthodontic Emergencies and Management

In this phase of the COVID-19 pandemic, reorganization of orthodontic services is very challenging for an orthodontist. Although most minor procedures have been postponed, it is necessary to manage acute orthodontic emergencies to avert further complications.

A true emergency in the field of dentistry is the one that is associated with swelling and infection of soft tissues, unbearable pain, bleeding, and so on. From an orthodontic perspective, emergencies may include trauma from the removable or fixed orthodontic appliance leading to severe pain and/or infection, circumstances related to dental trauma, or conditions where a lack of management would be harmful to the patient. Moreover, an orthodontist may not be able to leave a patient unattended for a long duration (10-12 weeks) to avoid further complications (43). The orthodontist should try and manage orthodontic emergencies over the phone or provide the patient with links con-

taining audiovisual aids available on professional websites that would guide them to manage minor emergencies at home. Table 1 lists some orthodontic emergencies that can be managed remotely (31).

Immediate attention is needed in cases of discomfort associated with various fixed orthodontic appliances where orthodontic intervention is required. Overextended distal wires, detachment of buccal tube, impinging ligature ties, loose bracket leading to laceration, and loose or broken bands are some of the common orthodontic emergencies observed. Virtualized orthodontic consultations and treatment approaches can be implemented in case of emergencies.

Post-lockdown, patients who need to be addressed first are those who are undergoing treatment mechanics that are not self-limiting, such as reverse curve NiTi wires, torquing auxiliaries, springs (pendulum or canine eruption spring), fixed functional appliances (Herbst), and lose temporary anchorage devices which, if left unattended, would lead to detrimental effects, increase in treatment duration, and reduction in patient motivation.

Less often, symptomatic treatment measures can be given to patients, including pharmacological management in case of pain and minor discomfort (44). Paracetamol should be advised in preference to ibuprofen (45).

Post-lockdown, passive self-ligation offers advantages in delaying appointments and offers fewer emergencies than elastomeric rings, where loose elastomeric rings or accumulation of food and plaque around elastomeric rings leads to emergency visit (46). These appliances are more comfortable, and patient follow-up can be minimized during this pandemic. Aligner therapy has advantages such as comfort, and short treatment duration. Yunyan et al. (47) have concluded that clear aligners had an advantage in segmented teeth movement and shortened treatment duration but were less effective in controlling torque and retention.

During leveling and alignment, reciprocal forces are generated between the teeth. Usually, practitioners start with light forces with round NiTi archwires that can lead to slippage of the wire from brackets because of excess amount of play. Square or rectangular NiTi wires are preferred to avoid emergencies owing to slippage. To prevent sharp ends impinging on the soft tissues, the archwires should be cinched back. Initial few visits during leveling and alignment should be scheduled with an interval of approximately 10 weeks during this pandemic to reduce patient exposure. Stainless steel ligature is more hygienic than elastomeric rings (48).

During the second or third wave of the pandemic, expansion treatment with rapid palatal expander, open coil spring used during alignment, and fixed functional appliances (Herbst or Class II correcter) requires close monitoring and therefore should be prescribed with caution. Alternative methods of NiTi slow expander, NiTi open coil springs, and fixed twin block would be preferable during this crisis, because they have fail-safe mechanics, minimizing the chance of emergencies (48).

Space closure can be accomplished with active tie-backs, and use of elastics for space closure should be avoided, because it requires continuous monitoring. Phase II treatment with fixed appliances should be delayed, and the retentive phase should be extended by placing an upper inclined plane (48).

Looking from a financial perspective, the treatment cost might remain the same post-lockdown with an additional cost charged for PPE to ensure safety of both the patient and clinician. Teledentistry or virtual consultations should continue with WhatsApp or Zoom video, maintaining communication with patients in the immediate future. This pandemic has produced scenarios that were never envisioned before and has affected the practice of orthodontics in particular and dentistry as a whole. Virtual consultations have certain advantages, such as easier monitoring of the patient without the need for personal contact, and help the patient psychologically. They are cost-effective for patients; however, they have certain disadvantages like a lower standard of care in orthodontics, no clear rules or guidelines available for virtual orthodontic care, legal issues, and so on. We would recommend adapting orthodontic mechanics that offer more convenient and fail-safe methods whenever required.

As the uncertainty of the pandemic continues, it is evident that up-to-date recommendations are needed. These recommendations should focus on the guidelines and rules that explain emergencies that an orthodontist must attend to in their clinics; guidelines for the screening and testing of the disease; and guidelines for obtaining consent, documentation, and comprehensive protocols for virtual or web-based consultations and appointments.

CONCLUSION

Unlike medical emergencies, orthodontic emergencies do not require immediate attention in most cases. With advances in the modern web-based communication systems, management of minor problems can be done online in an orthodontic practice. However, in some cases, pain and discomfort have to be taken care of as an emergency condition. The main focus and objective of an orthodontist when the patients come in for an emergency appointment are to take into account the complete history of the patient and the problem and relieve the patient of any pain and discomfort under the proper guidelines recommended by the WHO.

Peer-review: Externally peer-reviewed.

Author Contributions: Supervision – R.K., S.S.; Design – R.K., S.S.; Supervision – S.S., A.F.; Resources – R.K., S.S.; Materials – R.K., S.S.; Data Collection and/or Processing – R.K., R.R.; Analysis and/or Interpretation – S.S., S.B.; Literature Search – R.K., R.R.; Writing Manuscript – R.K., S.S.; Critical Review – S.S., A.F.

Conflict of Interest: The authors have no conflict of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

REFERENCES

1. Organization WH. Statement on the second meeting of the international health regulations (2005) emergency committee regarding the outbreak of novel coronavirus (2019-nCoV). Available From: https://www.who.int/ news-room/detail/30-01-2020.
2. Abdulamir AS, Hafidh RR. The possible immunological pathways for the variable Immunopathogenesis of COVID-19 infections among healthy adults, elderly, and children. Electron J Gen Med 2020; 17: 202. [Crossref]
3. Richman DD, Whitley RJ, Hayden FG, eds. Clinical virology, 4th ed. Washington: ASM Press, 2016. [Crossref]
4. Peng X, Xu X, Li Y, Cheng L, Zhou X, Ren B. Transmission routes of 2019- nCoV and controls in dental practice. Int J Oral Sci 2020; 12: 9. [Crossref]
5. Meng L, Hua F, Bian Z. Coronavirus Disease 2019 (COVID-19): Emerging and future challenges for dental and oral medicine. J Dent Res 2020; 99: 481-7. [Crossref]
6. Popat H, Rogers S, Knox J, Eckhardt C. Management of the Casual Orthodontic Patient. Orth Update 2010; 3: 9-13. [Crossref]
7. Dowsing P, Murray A, Sandler J. Emergencies in orthodontics. Part 1: Management of general orthodontic problems as well as common problems with fixed appliances. Dent Update 2015; 42: 131-40. [Crossref]
8. World Health Organization (WHO). Situation report-24. Geneva: WHO; 2020.
9. Zhao S, Lin Q, Ran J, Musa SS, Yang G, Wang W, et al. Preliminary estimation of the basic reproduction number of novel coronavirus (2019-nCoV) in China, from 2019 to 2020: A data-driven analysis in the early phase of the outbreak. Int J Infect Dis 2020; 92: 214-7. [Crossref]
10. Majumder M, Mandl KD. Early transmissibility assessment of a novel coronavirus in Wuhan, China. SSRN Electron J 2020: 3524675. [Crossref]
11. Read JM, Bridgen JR, Cummings DAT, Ho A, Jewell CP. Novel coronavirus 2019-nCoV: Early estimation of epidemiological parameters and epidemic predictions. Med Rxiv 2020. [Preprint]. [Crossref]
12. World Health Organization (WHO). Preliminary clinical description of the severe acute respiratory syndrome. WHO;2020. Available from:https://www.who.int/csr/sars/clinical/en.
13. Centers for Disease Control and Prevention. MERS clinical features. Atlanta, USA;CDC; 2019. Availablefrom:https://www.cdc.gov/coronavirus/mers/clinical features.html.
14. Jilani TN, Jamil RT, Siddiqui AH. H1N1 influenza (swine flu). In: Stat Pearls. Treasure Island, FL: StatPearls Publishing; 2020.
15. Backer JA, Klinkenberg D, Wallinga J. Incubation period of 2019 novel coronavirus (2019-nCoV) infections among travelers from Wuhan, China, 20-28 January 2020. Euro Surveill 2020; 25: 2000062. [Crossref]
16. Cascella M, Rajnik M, Cuomo A, Dulebohn SC, Napoli RD. Features, Evaluation, and Treatment Coronavirus (COVID-19). StatPearls Publishing, Treasure Island, FL; 2020.
17. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. J Am Med Assoc 2020; 323: 1061-9. [Crossref]
18. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: A descriptive study. Lancet 2020; 395: 507-13. [Crossref]
19. World Health Organization. Clinical management of severe acute respiratory infection when novel coronavirus(2019-nCoV) infection is suspected.Geneva:WHO;2020. Available from:https://www.who.int/docs/default-source/coronaviruse/clinical-management of novel cov.pdf. [Crossref]
20. Wang Y, Wang Y, Chen Y, Qin Q. Unique epidemiological and clinical features of the emerging 2019 novel coronavirus pneumonia (COVID-19) implicate special control measures. J Med Virol 2020; 5: 10.1002/jmv.25748. [Crossref]
21. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet 2020; 395: 497-506. [Crossref]
22. Hassan SA, Sheikh FN, Jamal S, Ezeh JK, Ali Akhtar A. Coronavirus (COVID-19): A review of clinical features, diagnosis, and treatment. Cureus 2020; 12: 7355. [Crossref]
23. Duan YN, Qin J. Pre- and posttreatment chest CT findings: 2019 novel coronavirus (2019-nCoV) pneumonia. Radiol 2020; 295: 21. [Crossref]
24. World Health Organization (WHO). Laboratory testing for 2019 novel coronavirus (2019-nCoV) in suspected human cases. Geneva: WHO; 2020.
25. World Health Organization (WHO). Laboratory biosafety manual, 3rd ed. Geneva: WHO; 2004. p. 186.
26. Pang J, Wang MX, Ang IYH, Tan SHX, Lewis RF, Chen JI-P, et al. Potential rapid diagnostics, vaccine, and therapeutics for 2019 novel coronavirus (2019-nCoV): A systematic review. J Clin Med 2020; 9: 623. [Crossref]
27. Centers for Disease Control and Prevention. Interim standard operating procedure (SOP)for triage of suspected COVID-19patients in non-US healthcare settings: Early identification and prevention of transmission during triage, www.cdc.gov/coronavirus/2019-ncov/hcp/non-us-settings/sop-triage-prevent-transmission.html.
28. Mayo Clinic. COVID-19 (coronavirus) self-assessment tool.www.mayoclinic.org/covid-19-self-assessment-too.
29. Turkistani KA.Precautions and recommendations for orthodontic settings during a the COVID-19 outbreak: A review. Am J Orthod Dentofacial Orthop 2020; 158: 175-81. [Crossref]
30. Zhang W, Jiang X. Measures, and suggestions for the prevention and control of the novel coronavirus in dental institutions. Front Oral Maxillofac Med 2020; 2: 4. [Crossref]
31. Suri S, Vandersluis YR, Kochhar AS, Bhasin R, Abdallah M. Clinical orthodontic management during COVID-19 pandemic. Angle orthod 2020; 90: 473-84. [Crossref]
32. Kohn WG, Harte JA, Malvitz DM, Collins AS, Cleveland JL, Eklund KJ. Centers for Disease Control and Prevention. Guidelines or infection control in dental health care settings-2003. J Am Dent Assoc 2004; 135: 33-47. [Crossref]
33. Harrel SK, Mollinari J. Aerosols, and splatter in Dentistry: A brief review of the literature and infection control implications. J Am Dent Assoc 2004; 135: 429-37. [Crossref]
34. Harte J. Standard and transmission-based precautions: An update for dentistry. J Am Dent Assoc 2010; 141: 572-81. [Crossref]
35. Ireland AJ, Moreno T, Price R. Airborne particles produced during enamel clean up after removal of orthodontic appliances. Am J Orthod Dentofacial Orthop 2003; 124: 683-6. [Crossref]
36. Day CJ, Price R, Sandy JR, Ireland AJ. Inhalation of aerosols produced during the removal of fixed orthodontic appliances: A comparison of 4 enamel cleanup methods. Am J Orthod Dentofacial Orthop 2008; 133: 11-7. [Crossref]
37. Day CJ, Sandy JR, Ireland AJ. Aerosols and Splatter in Dentistry - a neglected menace?. Dent Update 2006; 33: 601-6. [Crossref]
38. Doremalen NV, Bushmaker B, Morris DH, Holbrook MG, Gamble A, Williamson BN, et al. Aerosol and surface stability of HCoV-19 (SARS-CoV-2) compared to SARS-CoV-1. N. Engl J Med 2020; 382: 1564-7. [Crossref]
39. Fleming PS, Johal A, Pandis N. Self-etch primers and conventional acid-etch technique for orthodontic bonding: A systematic review and meta-analysis. Am J Orthod Dentofacial Orthop 2012; 142: 83-94. [Crossref]
40. Iliadi A, Baumgartner S, Athanasiou AE, Eliades T, Eliades G. Effect of intraoral aging on the setting status of resin composite and glass ionomer orthodontic adhesives. Am J Orthod Dentofacial Orthop 2014; 145: 425-33. [Crossref]
41. Eliades T. Future of bonding. In: Eliades T, Brantley WA, editors. Orthodontic applications of biomaterials. A clinical guide. Cambridge: Woodhead Publishing; 2017.p.267-71. [Crossref]

42. Health and Safety Executive. Evaluating the protection afforded by surgical masks against influenza bioaerosols: Gross protection of surgical masks compared to filtering facepiece respirators. 2008. Available From: https://www.hse.gov.uk/research/rrpdf/rr619.pdf.
43. Caprioglio A, Pizzetti GB, Zecca PA, Fastuca R, Maino G, Nanda R. Management of orthodontic emergencies during 2019-NCOV. Prog Orthod 2020; 21: 10. [Crossref]
44. Shyamala N, Anand S. Management of orthodontic emergencies - to act or not? Inter J Oral Health Dent 2018; 4: 205-7.
45. Zahran S, Wright N.A Review of COVID-19 and the ımplications for orthodontic provision in England. Orth Update 2020; 13: 117-24. [Crossref]
46. Pellegrini P, Sauerwein R, Finlayson T, McLeod J, Covell Jr DA, Maier T, et al. Plaque retention by self-ligating vs elastomeric orthodontic brackets: quantitative comparison of oral bacteria and detection with adenosine triphosphate-driven bioluminescence. Am J Orthod Dentofacial Orthop 2009; 135: 426-7. [Crossref]
47. Yunyan Ke, Yanfei Zhu, Min Zhu. A comparison of treatment effectiveness between clear aligner and fixed appliance therapies. BMC Oral Health 2019; 19: 24. [Crossref]
48. Srirengalakshmi M, Venugopal A, Pangilinan PJP, ManzanoP, Arnold J, Ludwig B, et al. Orthodontics in the COVID-19 era.The way forward part 2: Orthodontic treatment considerations. J Clin Orthod 2020; 6: 331-9.