



Review Article

Orthodontic practice and management during covid 19 era – A review

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ABSTRACT

COVID 19 was originated from Wuhan city of Hubei Province in China in December 2019. It is a viral disease spread due to severe acute respiratory Syndrome Coronavirus virus. The virus has been spread extensively worldwide leading to a worldwide emergency. The strain of the virus is new and not been studied earlier. However the transmission of the virus is quick and immoderate. Efforts to contain the spread of the disease have led to major disruptions forcing regional and in many cases national emergencies and lockdown, leaving only essential services to continue. Human transmission is predominantly through the respiratory track via droplets, respiratory secretions and or direct contact where the virus enters the mucous membrane of the mouth, nose and eyes. Although contact with symptomatic patients is the typical route of transmission, asymptomatic individuals or those within the viral incubation period may also be able to transmit COVID 2019. In many such efforts performing elective tasks including orthodontic treatment are required to be suspended on orders of the central, state and civic and public health regulatory bodies. Due to unrepresented nature of this pandemic and the unknown length of time that mandatory suspension of elective treatment may be in effect in different regions, consolidated information and guidelines for the clinical orthodontic management of patients during the COVID-19 pandemic are lacking.

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1. Introduction

The year 2020 commenced the outbreak of Coronavirus 2019(COVID-19) which is caused by severe acute respiratory syndrome Coronavirus 2 (SARS-CoV-2; first named as the 2019-novel Coronavirus or 2019-nCoV). The disease is pestilential and has spread throughout the world leading to unprecedented major health, humanitarian and financial crises.¹ The World Health Organization declared it a public health emergency of international concern on January 30, 2020, reflecting the grave seriousness of this pandemic.²

The character of the virus' infectious route, with direct generation of airborne droplets in the form of aerosol, has revealed a great number of potential hazards impeding

conventional and standard oral health care procedures.³ It is nearly impossible to keep orthodontic practices completely aside. The Coronavirus Disease 2019 (COVID-19) pandemic has had profound effects on orthodontic care delivery worldwide.⁴

Considering the generation of copious amounts of droplets along with the aerosols formed during routine dental procedures, the conventional protective measures routinely followed by dental clinicians are unfortunately no longer efficient for prevention of COVID-19 transmission.⁵ According to a report by the New York Times, dental clinicians have the highest risk of exposure, even higher than that of nurses, physicians and pharmacists.⁶ Under such situations, dental management of patients requires unusual and distinctive precautions, which have not been practiced or preached before.⁷

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Among all health care professionals, the highest infection potential was reported for dentists, dental assistants, and dental hygienists. The main source of infection was close contact with patients, and exposure to spatter of patient's secretions, saliva, and aerosol.⁸ Viewing this, dental offices are pertinent hotspots for virus transmission, better knowledge of the virus transmission, proper screening and personal protective measures along with constructive management protocols for dental practices to identify the disease and prevent its further spread of infection to the patients and clinicians is of utmost importance.⁹

We must all carefully anticipate and be alert as well as prepared for the effects of unsupervised orthodontic treatment in case a future lockdown is imposed in the wake of a COVID-19 resurgence.¹⁰

The aim of this review was to provide a comprehensive compendium of the implications and complications of SARS-CoV-2 and COVID-19 on orthodontic treatment and to discuss the contingency management and delivering emergency orthodontic care, using currently available data and literature.¹

2. Transmission

2.1. Risk of disease transmission within the orthodontic practice

Dentistry, along with orthodontics, requires close contact with patients while performing clinical operator procedures. Woefully, this puts the dental healthcare workers at a major risk of acquiring infectious diseases.¹¹ The infection is extremely contagious, with disease transmission reported from asymptomatic carriers. It spreads from person-to-person contact via aerosol and droplets. The practice of social distancing—maintaining a distance of 1-2 m or 6 ft—between people has been recommended worldwide to halt the spread. In orthodontics, this distance is difficult to maintain, which keeps the orthodontists at a higher risk of acquiring and transmitting the infection.¹²

In order to take act according to the situation preventive measures, conscientious knowledge and the modes of transmission of this infectious virus is necessary. Coronavirus is transmitted directly (sneeze, droplet inhalation transmission and cough).¹³ The various other means of transmission are through contact i.e. contact with nose, eye, mucous membranes and oral routes. Respiratory viruses can be transmitted from person to person either by direct or indirect contact or through coarse or small droplets as per the detailed studies. COVID-19 is transmitted through saliva directly or indirectly as well.¹⁴ A case report in Germany shows that the viruses are transmitted through contact with asymptomatic patients.¹⁵ COVID-19 might be airborne as per the studies revealed/suggested through

aerosols produced during medical procedures.¹⁶

Source of spread also includes direct contact with oral fluids, blood and direct contact with patient used materials.¹⁷ Non use of mask, indirect contact with contaminated instruments, and/or environmental surfaces account mainly for transmission.^{18,19} Contact with conjunctival, oral mucosa or nasal droplets and aerosols containing virus laded microorganisms generated from an infected individual are the main source of infection. Transmission is also via indirect contact with contaminated instruments and/or environmental surfaces.²⁰ Infected individual may spread/transmit infections in any of the above conditions. Our concern is during the outbreak of COVID19. (Figure 1)²¹

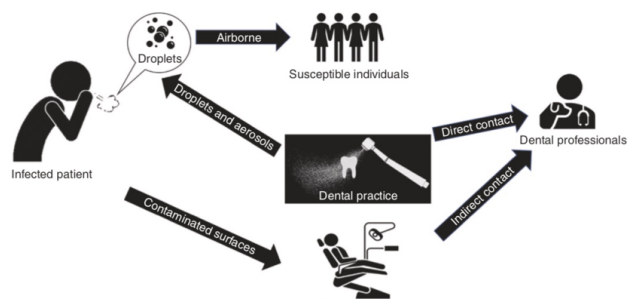


Fig. 1: Illustration of routes of transmission of COVID19 in dental clinics and hospitals.²¹

2.2. Incubation, latency, and contagious period.

The incubation period of SARS-CoV-2 as noted from data ranges from 1 to 14 days, with an average of 3-7 days (Figure 2).²² The time from exposure to infection i.e. (latent period) is shorter than the incubation period, as COVID-19 can spread through asymptomatic or mildly symptomatic carriers too.²³ Generally, patients are considered to be in convalescence when they present with the following: (1) a normal body temperature for more than 3 days, (2) no respiratory symptoms, and (3) two negative oropharyngeal swab reverse transcription-polymerase chain reaction (RT-PCR) viral ribonucleic acid (RNA) tests that are taken at least 24 hours apart.^{24,25} However, SARS-CoV-2 detection can also occur after this, as seen from RT-PCR test results 5-13 days later.²⁵ Figure 2

2.3. Clinical manifestations

COVID-19 manifestations follow an unexpected sequence ranging from a complete lack of symptoms to symptomatic patients with severe complications leading to multiorgan dysfunction, septic shock, and systematic failure. COVID-19 can further be classified into mild, moderate, severe, or critical diseases.^{26,27} In a retrospective study of 72,000 cases, 81% of symptomatic patients presented with mild

symptoms, whereas severe and critical symptoms were seen in 14% and 5% of the cases, respectively.²⁷

Most COVID-19 patients experience a wide range of symptoms which include dry cough, fatigue, and fever. Shortness of breath and gastrointestinal symptoms (diarrhoea, vomiting), are few of the atypical symptoms. Sore throat, severe headache, confusion, and muscle pain, might also occur. A small cluster of patients unluckily develops severe complications, including respiratory distress syndrome, shock, and arrhythmias, and some of which can lead to death.^{28,29} The proportion of severe or fatal infection varies among countries and the estimated case fatality percentage, as of April 5, 2020, varies between 0.33% and 11.03%.³⁰

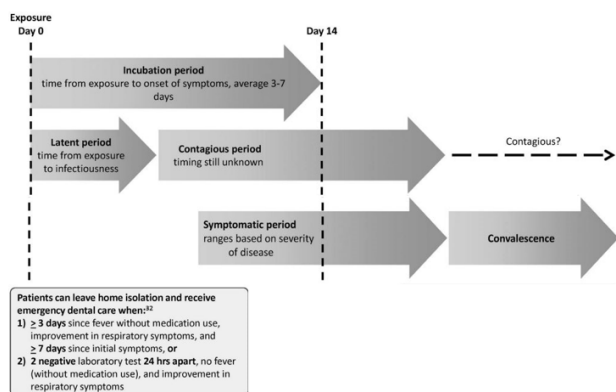


Fig. 2: Incubation, latency, symptomatic, and contagious periods of SARS-CoV-2.²²

2.4. Preventive measures

1. Evaluation and screening of patient: In general, it is necessary to postpone any routine appointments and restrict patients' visits for emergency procedures only.^{31,32} Sifting patients for COVID-19 symptoms and noting their body temperature is essential.³³⁻³⁵ Updating the patient's medical history and asking targeted questions relevant to COVID-19 before initiating any dental work is mandatory.³³ This includes
 - A. History of pyrexia (37.3C or higher) or use of antipyretic medication in the past 14 days;
 - B. Symptoms including lower respiratory tract infection, including dyspnoea in the past 14 days;
 - C. Travel history to a COVID-19 epidemic area in the past 14 days; and
 - D. History of close contact with a confirmed COVID-19 case in the past 14 days.
2. In case the patient is a known asymptomatic carrier (with no symptoms and fever), then re-appoint and advise the patient for self-quarantine at home for 14 days. Rarely a confirmed COVID-19 patient with

acute symptoms will visit the orthodontic clinic. Even if the patient showed any symptoms, reporting and referral to COVID-19 prepared hospitals is mandatory (Figure 3).³³⁻³⁵

3. Daily self-evaluation of the dental health care provider is strictly advised. If the orthodontist does not feel fine or has developed any symptoms, he/she is prohibited to work and spread infection.³⁶
4. Mouth rinse before any procedure using 0.12%-0.2% chlorhexidine gluconate could help minimize the number of microbes within the oral cavity.^{34,37}
5. Personal protective equipment, including facial masks, face shields, eye protection, gowns, and gloves, are essential protective gear during the outbreak.^{6,27,48,50} COVID-19 was reported to transmit through contact of the virus with ocular mucosa; thus, any contact with mucosal tissue of the eyes, nose, or mouth should be avoided.^{31,38}
6. Aerosol production should be restricted, and if necessary, particulate respirators such as N95, EU FFP2, or equivalent in addition to face shield are required.^{31,34,36,39} Although COVID-19 was categorized as group B infectious disease, the guidelines suggest that healthcare providers perform protective measures similar to those reserved for group A infectious diseases (such as cholera and plague).⁴⁰
7. Reinforcement of hand hygiene measures according to WHO recommendations (washing hands for 20 seconds minimal) is essential to combat this robust microorganism.^{33,41}
8. Training of the orthodontic team on the diagnosis of the disease, symptoms, routes of transmission, infection control measures, and keeping up with regulation updates are extremely beneficial and important during SARS-CoV-2 infection crisis.^{31,35,36,39}
9. Adequate ventilation of the operatory and waiting area with new air, high airflow or air filters is advised, with special attention to minimizing the number of patients in the waiting area and allowing adequate space for social distancing.^{34,39,42}
10. The operation room could be tainted with droplets and aerosol. A recent study reported SARS-CoV-2 viability up to 3hr in aerosol, with a half-life of 5.6hr on stainless steel and 6.8 hr on plastic surfaces.⁴³ Therefore, strict surface disinfection protocol should be followed after every patient.
11. Medical wastes during the outbreak should be handled as infectious medical wastes. Double layer yellow anti-leakage medical waste marked with a special tag is recommended.^{33,35,44,45} (Figure 3)

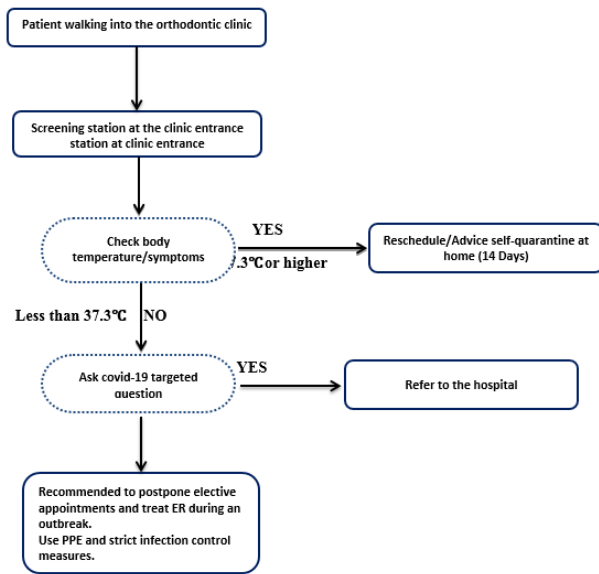


Fig. 3: Patient screening flowchart.³³⁻³⁵

2.5. Sterilization Protocol

Dental professionals should be familiar and be updated with how SARS-CoV-2 is possibly spreading, how to cognize patients with SARS-CoV-2 infection, and what precautionary measures should be adopted, practiced and preached during routine clinical procedures to prevent the transmission of SARS-CoV-2. Here, we reinforce the standard infection-control protocol that should be followed by dental professionals, though these may be subject to alteration and addenda, considering that aerosols and the droplets give rise to SARS-CoV-2. One might apply the aphorism, “Absence of evidence is not evidence of absence,” or argumentum ad ignorantiam: a common fallacy of logic. Advance knowledge certainly allows for advance preparation: forewarned is forearmed.⁴⁶

Our propositions are based on Guidance on Preparing Workplaces for COVID-19, established by the Occupational Safety and Health Act of 1970.⁴⁷ The ADA recommends that all surfaces of the working area, especially those touched often, should be wiped with Environmental Protection Agency (EPA)-registered surface disinfectants and that instruments be autoclaved along with dental handpieces. It is essential to act according to the manufacturer’s instructions for use of any product mentioned in this article.⁴⁸

Medical waste, including disposable personal protective equipment (PPE) post usage, should be transported to the temporary storage area of the dental facility in a timely and hygienic manner. Reusable instruments and other clinical instruments should be cleaned, sterilized, and properly stored in accordance with the CDC Guidelines for COVID-19 Medical Waste Disposal.^{49,50} The CDC notes

that “medical waste generated from healthcare facilities treating COVID-19 patients is in no way different than waste coming from facilities without COVID-19 patients.” CDC’s guidance states that the management of laundry, food-service utensils, and medical waste should be treated in accordance with routine procedures. There is no current evidence to suggest that facility waste needs any additional disinfection.⁴⁸

2.5.1. Pre-Appointment Screening and Triage

Triage includes instituting an office hotline for teleconsultation that will provide a source of communication for the patient who wishes to visit a health-care facility or provide support in following social-distancing protocols. Our teams should also make the patients aware of preventive measures to undertake before they come to our offices. Screening or self-assessment tools as published by CDC and the Mayo Clinic include the following questions:^{51,52}

1. Have you been part of large gatherings and/or gatherings of people unrelated to you?
2. Have you travelled to or spend time in a country/area reporting local transmission of COVID-19?
3. Have you been in close contact less than six feet of a person with a lab-confirmed case of COVID-19 for more than five minutes, or had direct contact with their mucous or saliva, in the past 14 days?
4. Have you experienced any of the following symptoms within the last 48 hours?
 - a. Fever 100.4°F or above, or potential fever symptoms such as alternating shivering and sweating
 - b. Cough
 - c. Difficult to breath, shortness of breath, or severe wheezing
 - d. Chills
 - e. Muscle aches
 - f. Sore throat
 - g. Diarrhea
 - h Anosmia or loss of taste or change in taste
5. Were you a patient who has recovered from COVID-19?

If all answers are Negative: An appointment can be scheduled to manage an orthodontic emergency.

If any or all of questions 1, 2, or 3 were answered YES: Recommend self-quarantine procedure first, secure clearance, and screen again.

If any or all of questions 1, 2, 3, or 4 were answered YES: Refer the patient to a hospital for management. If question number 5 was answered YES: The patient should first secure a clearance. Figures 4 and 5

Table 1: Recommendations and safety measures to minimize aerosols in orthodontic practice, per procedure.⁵⁴

Procedure	Aerosol liable actions (conventional)	Safety measures	Future perspectives
Etching	High thickness and/or viscosity gel	Liquid gel and/or low viscosity and/or no rinsing	Non-etching mediated bonding
Bonding	Conventional resin-based adhesive	Glass-ionomer cement BPA- free adhesives	Biometric based bonding with use of L-DOPA primers
Debonding	Standard debonding with considerable amounts of adhesive remnants on enamel surface Standard rotary grinding to clean-up enamel Attachment grips for aligner treatment Preprocedural measures Personnel equipment and/or settings	Alteration of adhesive- bracket base Identify bracket base mesh and/or shape and/or size and adhesive combination for cohesive resin fracture Removal of significant amounts of resin remnants with hand-instruments-avoid rotary instruments as much as possible Use of tungsten burs w/o water cooling for limited trace composite remnants (i.e., individually debonded brackets during treatment) Use of tungsten burs, under water cooling for enamel clean-up after debonding and/or attachment removal. Careful selection of patients and/or malocclusion for treatment with aligners; abandon company preset distribution of arrays of attachments. Attachment-free aligner treatment Use of BPA free composite to eliminate estrogenic activity (ie, PCDMA) Mouthrinse with (47 °C) CHX 0.12%-0.2% for bacterial pathogenesis. (0.5-1min) Mouthrinse with 0.2%-1% PI or 1% H ₂ O ₂ for oxidation vulnerable viruses (0.5-1min) Facemask, shield, gown, apparel for all the clinic personnel, and fresh air and surgical suction.	Interface expandable particles and ferrous micro-particles) Irradiation of specific wavelength to reverse polymerization Biometric bonding agents would eliminate use of rotary instrumentation Temperature control and variation of adhesives(heat and/or freezing) Plasticizing and/or brittleness

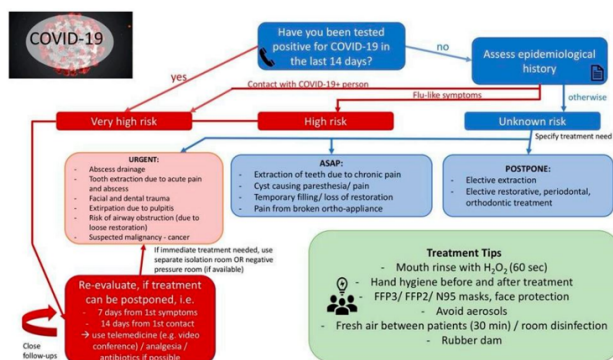


Fig. 4: Patient triage recommendations (diagram). COVID-19, coronavirus disease 19; ASAP, as soon as possible.⁹

2.6. Aerosol Generating Procedures (AGP) and splatter in dentistry

These procedures are clinical care procedures that result in the generation of airborne particles. The first one to coin these terms was Micik and his colleague, aerosol and splatter at the time when they were working on aerobiology. An aerosol is defined as those particles which have lesser than 50µm diameters. They are quite small enough to stay in the air before settling down or entering the respiratory tract. Diseases like Pneumonic plague, influenza, Legionnaire’s

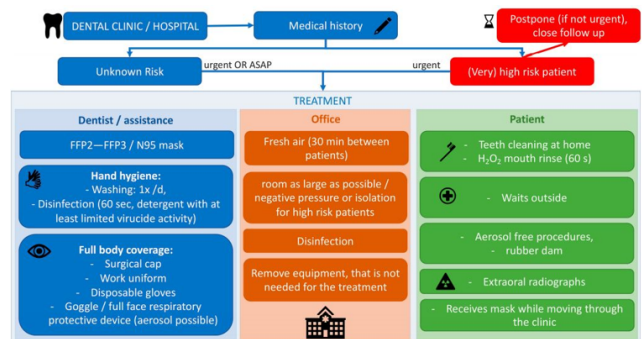


Fig. 5: Measures to prevent cross-infection and nosocomial transmission at dental hospitals (diagram). FFP, Filtering Face Piece.⁹

disease, and Severe Acute Respiratory Syndromes are transmitted through aerosol. On the other hand, the term splatter is defined as those particles that have a diameter greater than 50µm. These particles are larger in size and cannot survive in the air. Hence there are maximum chances of cross infection in the field of dentistry through aerosol which is airborne and can enter the respiratory tract. Splatters are a major threat of cross-infections. TB is transmitted through the droplet nuclei produced during coughing or sneezing of an infected individual or from the

splatter of the ongoing dental procedure. Thus splatter and droplet nuclei also transmit infectious diseases from patients to dental professionals like measles, herpes, and SARS.⁵³ (Table 1)

2.7. Patient management algorithm.⁵⁵ (Figure 6)

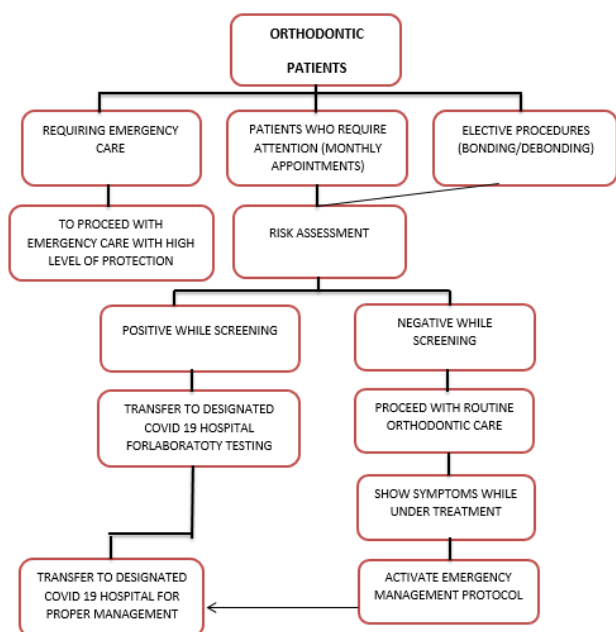


Fig. 6: <https://www.iosweb.net/images/covid-19/Post-Covid-advisory.pdf>

2.8. Management of Orthodontic Emergency Protocol

The clinician can assess upon his/her understanding whether to keep the clinic functional or to manage emergency cases only. According to the guidelines of the single Nations, the routine orthodontic appointments can and should preferably be postponed.⁵⁶ Patients requiring to follow-up or undergoing any discomfort or problems related to the appliance should compulsorily be checked personally. Repeated breakages lengthen treatment time and lead to loss of confidence in appliance or operator and thus hamper patient motivation.⁵⁷ According to single Nations guidelines during COVID-19 pandemic. The dentists in their private practice should accept only non-deferrable urgencies, such as an abscess or irreversible pulpitis. And Orthodontists other than the general dentistry problems, representing urgencies, a video call or message with a photo might be the best options to evaluate the case.⁵⁶ (Table 2)

2.9. Virtual tools

Given the present pandemic situation, in which patient's access to practices has been interrupted, virtual tools

for dentistry⁵⁸ and orthodontics have gained increasing popularity. Patients can use a wide variety of available technology to take intraoral “selfies” with smartphones. Photos of these patients are automatically sorted, angulated, cropped, and organized according to the date. The orthodontist can access patient details from any device at any time through a common portal. Virtual pre-screening or triage, as well as more immediate solutions to assess and monitor treatment and communicate with our patients, have been made possible by such digital tools.⁵⁹

2.10. New Start

There is a probability that a future assault of COVID-19 would be even more challenging than the one we just went through. Hence, there is a need to institute clinical measures and guidelines for use in orthodontic practices to be followed during pandemics. As with available information in this continually evolving situation, it is most important that you do your own due diligence and carefully evaluate everything for yourself. The measures and guidelines offered in this two-part article will stimulate thought and provide a rationale for:⁵⁹

1. The need for greater extensive COVID-19 testing, as well as guidelines for the personal protective equipment required for specific procedures in orthodontic practices.
2. Potential changes in office environment and infection control.
3. Compendious protocols for virtual consultations and appointments that can assure adequate patient care.
4. Knowledge of and skill with orthodontic mechanics, with the intent of anticipating potential adverse effects and offering more convenient and fail-safe methods to avoid emergencies in the immediate future.

It is true that it takes only one rotten apple to rot the rest: i.e. one asymptomatic virus spreading vectors such as an insistent “helicopter” parent, a service vendor, or even a negligent employee may slip through and ruin our health. It is important, therefore, to note that despite of our implementation of the most meticulous techniques, equipment, and practices, some people may still catch the virus. Our intent has been simply to offer options that can reduce those odds in an orthodontic practice for the benefit of our families, teams, and patients.⁵⁹

COVID-19 beyond doubt is going to stay for a long time; as a result, it may forever change the way we practice orthodontics. While bestowing our treatment, we must heighten our compassion for patients and enhance our sense of camaraderie and professionalism with staff and colleagues. With these factors in mind, we can get through this successfully, together.⁵⁹

Table 2: Orthodontic emergencies⁵⁶

Removable appliances	Functional	If the appliance does not fit well or is broken, send photos to the orthodontist and stop the usage.
	Aligners	Remain on the current/go on with treatment following clinician's indications/if broken or lost get back to the previous and ask the clinician
Fixed appliances	Retainers	If broken or lost, ask to the dentist to evaluate buying hot customizable preforms on e-commerce sites
	Non removable appliances (e.g. straight appliance)	-Loose Bracket: Initially send photo to dentist, remove with tweezers eventually. -Poking distal wire: Click and Send a photo, use wax, cut with disinfected nail clipper/hardwire cutter. -Poking ligature: Photo to be sent to dentist, use wax, push it back with eraser of a pencil. -Periodontal abscess developed around molar band: Send photo, symptomatic therapy with FANS/paracetamol, eventually prescription of antibiotic. -Must be suspended a priori to avoid future emergencies.
	Non-removable appliances activated by patient (eg. Face mask, headgear or lip bumpers, palatal expanders) Pre-activated, non-removable appliances (eg. Pendulum, Forsus, Distal Jet appliance, transpalatal bar)	Pre-activated, non-removable appliances (eg. Pendulum, Forsus, Distal Jet appliance, transpalatal bar)

3. Conclusion

COVID 19 is an unfortunate guest in our lives. However, we need to mould our lives according to this deadly pandemic. The transmission of the disease is extremely contagious. It must be our sole responsibility to follow all the guidelines and with utmost precautions carry out clinical procedures. As the risk of the disease is the most for dental professionals, it is important for us to think out of the box and make necessary changes in standard procedures for the safety of the patients and the dentist as well. Use of personal protective equipment, gloves, eyewear and mask is highly recommended. It is important to spread the message of awareness with the help of webinars and lectures for better understanding of the subject. The more we know the better we practice!

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5. Conflict of Interests

The author declares that they do not have any conflict of interests.


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