



Review

Guidelines of Revised Orthodontic Practices for Establishing “New Normality” Post COVID-19 Pandemic

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Main Points

- Embracing the environmental modifications such as the use of high volume evacuation systems, drying of dental unit waterline, and procedural modifications such as the use of resin-modified glass ionomers (RMGIC) and lasers will help us to obtain a more disease-free environment.
- New categorization of orthodontic emergencies helps us to delineate the necessary procedural modifications.
- Incorporation of procedures such as pre-orthodontic screening and post-orthodontic clean-up aids to prevent and protect the spread of the infection.

ABSTRACT

The aim of this article is to shed light upon formulation of new guidelines of revised orthodontic practices in the post-pandemic era caused due to the novel coronavirus disease 2019 (COVID-19) and also to adapt to the new regulations to prevent further spread of infection. All relevant information pertaining to the area of concern was collected using electronic databases which include Google Scholar, PubMed, Cochrane, orthodontic journals, and health bodies such World Health Organization, the British Orthodontic Society, and the National Institute of Health. Post-pandemic visionary was also contemplated. Data collected through the electronic databases were studied and compiled to provide an overview of the possible modifications which could be employed to prevent cross-contamination during and after the orthodontic therapy in the -post-pandemic era. Refashioning of the dental set-up along with the formulation of new regulations have been elucidated. This review highlights that the post-pandemic orthodontic practice is a divergent layout requiring tedious clinical and environmental modifications. New categorization of patients requiring orthodontic treatments and procedural classification based on generation of aerosol must be taken into consideration. Formulation of new regulations and redesigning the clinical set-up is crucial yet essential.

Keywords: New normality, post-pandemic, dentistry, orthodontics, COVID-19

INTRODUCTION

The year 2020 has been marked distinctly by the pandemic outbreak of the coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). As per current reports, the disease was reported first in Wuhan, China in December 2019.¹⁻³ However, the clear-cut data regarding how, when, and where this disease originated is still disguised. The COVID-19 virus has spread rapidly and has left behind an indelible scar in many places throughout the world. It has led to global health, humanitarian, and financial crisis owing to a public health emergency catastrophe of international concern.

According to current evidence, the COVID-19 virus is primarily transmitted between people through respiratory droplets.² Considering this fact, dentists are at the highest risk for exposure to this virus since the

saliva and aerosols along with splatter aids the spread of the virus. As orthodontists consult many patients on a single day with long and continuous treatment procedures, effective prevention of the novel coronavirus is more strenuous. Owing to the extended treatment procedures and children comprising the majority of the orthodontic patients, strict infection control measures have to be followed for an efficient orthodontic practice. A number of preventive measures such as usage of personal protective equipment (PPE), decontamination of the office, and training of the orthodontic team in sterilization and disinfection protocols play a major role in infection control.⁴ As Sir Albert Einstein rightly said, "In the middle of difficulty lies opportunity," the crisis should be considered as a good time to formulate new protocols and adapt them in our daily practice. This new adaptation is solely the "new normality" that fortifies us and others from the novel coronavirus. The aim of this article is to shed light upon the formulation of new guidelines of revised orthodontic practices in the post-pandemic era caused due to the novel coronavirus disease 2019 (COVID-19) and also to adapt to the new regulations to prevent further spread of infection.

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METHODS

A broad selection of all relevant articles pertaining to the pandemic and its effects on the orthodontic practice was obtained from electronic search engines such as Google Scholar, PubMed, Cochrane, orthodontic journals, and health bodies such World Health Organization, the British Orthodontic Society, and the National Institute of Health. All articles regarding the orthodontic procedures at menace and its possible substitutions were also identified in a similar manner. The entire collected data were analyzed thoroughly to obtain all the relevant information. Orthodontic emergencies which could arise during the pandemic were also evaluated using various studies and surveys in the literature and were aggregated to pick out the frequent ones. Solutions to these emergencies and substitutions to different procedures and materials were identified and agglomerated in this article.

RESULTS

Orthodontic procedures are regarded as less life-threatening until it loses cohesion. Hence, many articles were directed toward emergency orthodontic management during the pandemic. Many such procedures could also be adopted in the post-pandemic aeon. Nevertheless, the need for embracing new categorization and revamping the clinical procedures is obligatory. The etiological and preventive aspects of the COVID-19 pandemic have been explained vastly in the literature. Few articles were also identified pertaining to the emergency arising during the pandemic situation.^{5,6} Nevertheless, the exact technique in substituting orthodontic procedures by employing clinical modifications and procedural modifications was not identified. Hence, this article has been formulated to elaborate the implications of possible modifications which could be employed during the pandemic situation and in the post-pandemic era as well.

DISCUSSION

Classification of Orthodontic Procedures

Orthodontic treatment procedures can be classified into aerosol-generating procedures (AGPs) and non-aerosol-generating procedures (NAGPs).

Aerosol-generating procedures include:

- High-speed air rotor drills including surgical drills
- Slow-speed drills, run wet and dry, including surgical drills
- 3-in-1 spray
- Ultrasonic and sonic handpieces for scaling
- Air-abrasion or intra-oral sandblasting for recycling brackets

Non-aerosol-generating procedures include:

- Replacing archwires
- Activation of intra-oral appliances
- Changing elastomeric chains and elastic
- Review for functional and orthopedic appliances

Aerosol-generating procedures can be substituted by alternative methods wherever possible. However, in cases wherein an alternative approach is not possible, then a separate room set-up for carrying out AGPs would be of great importance. Hence it would be wiser to have 2 separate rooms to practice AGPs and non-AGPs separately and a separate room for donning and doffing. In total, 3 rooms apart from the reception area are essential (Figure 1).

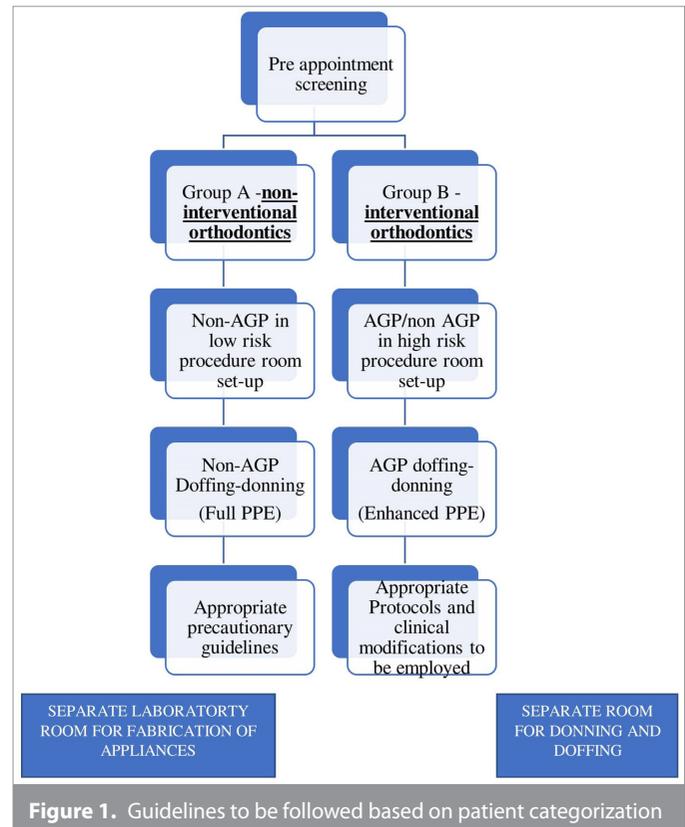


Figure 1. Guidelines to be followed based on patient categorization

Classification of Orthodontic Patients

Patients seeking orthodontic therapy can be newly categorized under the following 2 categories:

- (A) Non-interventional orthodontics and passive orthodontic appliances
- (B) Interventional orthodontics and active orthodontic appliances

Non-interventional Orthodontics and Passive Orthodontic Appliances

This category includes patients requiring monitoring of tooth eruption and dental arch development with the following procedures to be addressed:

- Periodic orthodontic reviews/Dental check-ups
- Passive appliances and interventions involving the use of the following: holding or space maintenance, habit-breaking appliances, etc.
- Serial extractions
- Retention appliances

In these patients, NAGPs can be carried out with appropriate PPE and disinfection guidelines.

Interventional Orthodontics and Active Orthodontic Appliances

This category includes patients requiring monitoring of tooth eruption and dental arch development with the following procedures to be addressed:

- Dentofacial orthopaedic appliances
- Functional appliances
- Fixed appliance Mechanotherapy (including adjunctive mechanical aids)
- Aligner therapy

These patients require a high-risk procedure room set-up with stringent protocols and environment modifications as well as clinical modifications.

Personal Protective Equipment

Personal protective equipment including facial masks, face shields, eye protection, gowns, and gloves is essential protective gear for dental practitioners and assistants during consultations. However, the type of PPE worn during the treatment procedure can be altered. There are 3 basic types of PPE namely:

- a) Standard PPE
- b) Full PPE
- c) Enhanced PPE

- Standard PPE can be recommended during pre-appointment procedures and in the reception area.
- Full PPE can be recommended for non-interventional orthodontics and passive orthodontic appliances using NAGPs and low-risk AGPs.

- For patients in need of interventional orthodontics and active orthodontic appliances with AGPs and high-risk NAGPs, enhanced PPE should be employed.
- In any types of PPE adopted, stringent protocols have to be followed for donning and doffing.

Revised Orthodontic Practices

In all of the above-mentioned categories, we intend to consider the following guidelines:

- a) Screening and pre-appointment
- b) Clinical modifications
- c) Post-consultation

Screening and Pre-orthodontic Procedures

Appointments for orthodontic purposes can be obtained through a digital platform using the hospital's website/through phone calls. Primary consultation can be performed through video calling by making use of portals such as zoom/google meet/doxy.me. Emergency cases also should be given appointments and walk-in should be avoided as much as possible. Patients must not be encouraged to bring other family members with them except for children who can be accompanied by 1 parent.

Upon patient's arrival, the dental hygienist/receptionist greets the patient and instructs them to wash their hands or use hand sanitizer. The patient is then advised to remain in the waiting area. The need for history taking is inescapable and hence a COVID 19 disclosure/consent form becomes mandatory. Digital copies of the forms are more preferable thus preventing cross-contamination. The form should include all but not limited to the following questions:

1. History of fever (37.3°C or higher) or use of antipyretic medication in the past 14 days.
2. Symptoms of lower respiratory tract infection including dyspnea in the past 14 days.
3. History of travel to a COVID-19 epidemic area in the past 14 days.
4. History of contact with a confirmed COVID-19 in the past 14 days.

The body temperature of the patient has to be checked using a thermal scanner. Infra-red sensors have proven to be more effective since it records the core body temperature rather than the superficial skin temperature. Pulse oximeters are being a vital tool to check the oxygen saturation levels before starting the procedure. Patients in the waiting area must be insisted to maintain social distancing.

Upon examination, if the patient is suspected asymptomatic then the appointment is rescheduled and the patient is advised to self-quarantine themselves at home for 14 days. If the patient is asymptomatic, further clinical procedures can be carried out. Mouth rinse before any procedure using 0.12% to 0.2% chlorhexidine gluconate could help minimize the number of microbes

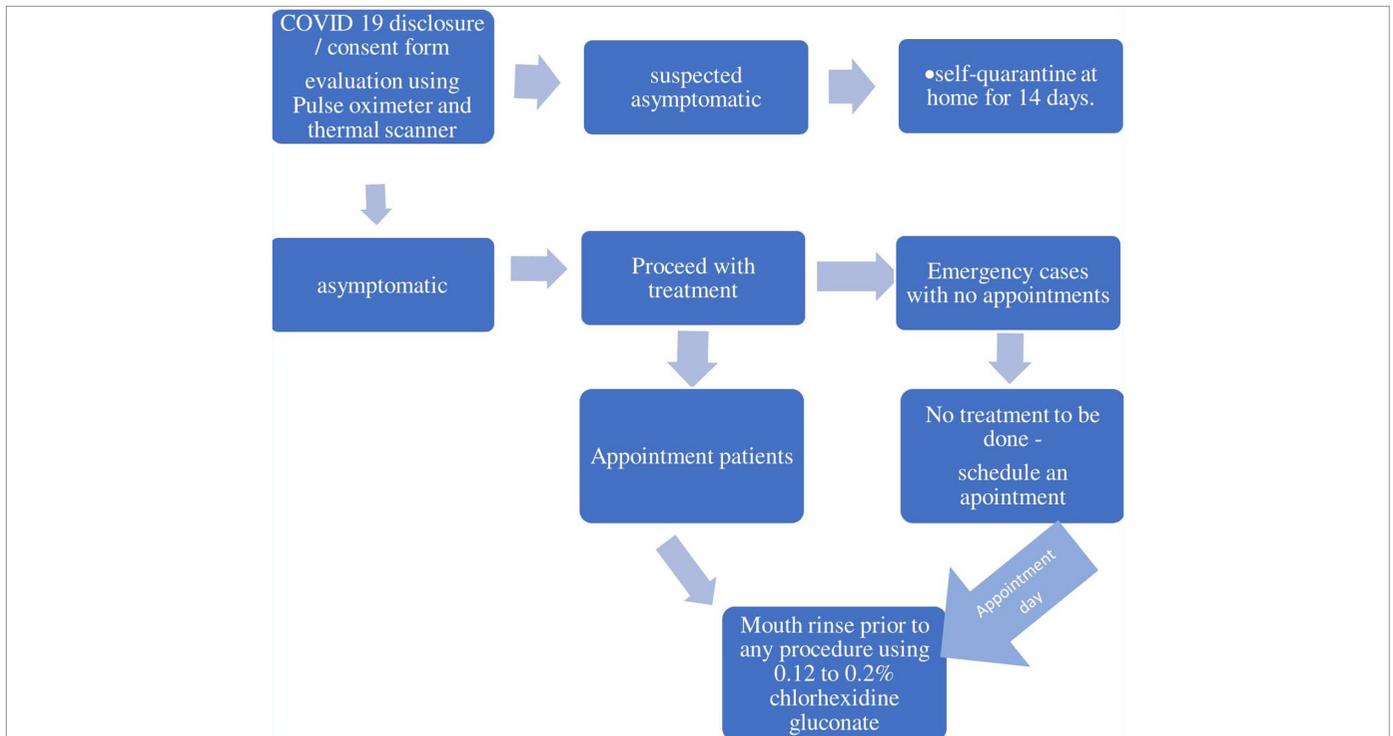


Figure 2. Pre-orthodontic preparation protocols

within the oral cavity (Figure 2). Previous studies have shown that oxidizing mouthwashes reduce the viral load and the nasopharyngeal microbiota thus acting as a valuable adjunctive therapy.⁷

Clinical Modifications

Orthodontic clinical modifications have to be adapted to reduce the risk of aerosol contamination. These modifications have to be employed in and around the working area which is called environmental modification. The orthodontic procedures which have been followed for a long time also have to be modified which is referred to as procedural modifications.

Environmental Modifications

The working area remains to be a hub for infectious organisms to laden. Specifically, electronic gadgets are given the least care for disinfection. Prescribing drugs for patients using prescription pads remains customary especially in the developing countries. These are a few inconspicuous areas wherein thorough decontamination is obligatory.

Cordless electrostatic sprayers are available for hands-free disinfectant application which can be used for decontamination of the working as well as non-working areas. Intra-oral and extra-oral aerosol evacuation systems must be installed to protect the operator from airborne contaminants. Various extra-oral mobile high-volume evacuation (HVE) systems are available in the market which helps in close-to-the-mouth evacuation of the aerosols. Combining extra-oral HVE systems and intra-oral low-volume evacuation (LVE) systems can be more rewarding.

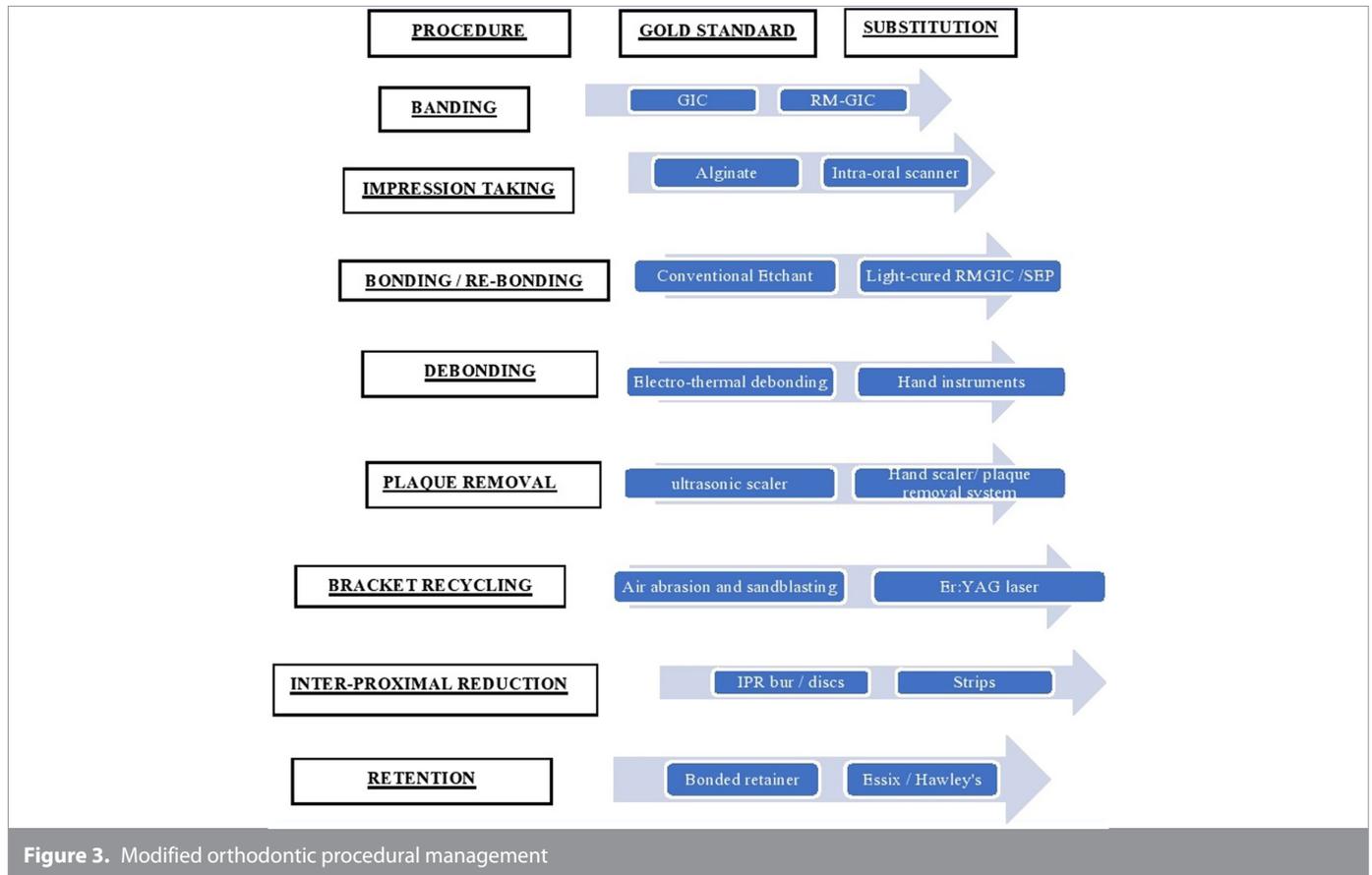
The following are the key environmental modifications to be adhered to:

- Decluttering of working slabs
- Computers screens, mousepads, keyboards, light cure units, instrument trays, headrest, chair light, suction tubes, etc. should be covered with barrier films.
- Printed prescriptions are preferred over handwritten prescription pads.
- At least 3-4 sets of instruments such as distal end cutters, archwire cutters, pin, and ligature cutters, Light arch pliers, and Mathews forceps must be packed individually and made available.
- Air purifier with a high-efficiency particulate air (HEPA)-14 must be available in the room.
- A combination of extra-oral and intra-oral evacuation systems to be installed

Procedural Modifications

Various clinical procedures and materials which are being acted in accordance with have to undergo a few modifications to lower the risk of infection and cross-contamination (Figure 3). The procedures which are at risk include:

- Impression taking
- Banding
- Bonding/Re-bonding
- Debonding
- Plaque removal
- Acrylic appliances
- Extractions



- Inter-proximal reduction
- Retention

Impression Taking

Although the present era is for digital therapy using computer-aided designing and computer-aided manufacturing (CAD-CAM) aligners, practical considerations for complete aligner therapy for all the patients are not possible due to the financial considerations of the majority of the population. However, the impression-taking procedure can be performed digitally using intra-oral scanners. The conventional impression taking provokes gag reflex as well as cough in certain individuals thereby mediating the spread of infection to longer distances. The goop and gag being the main disadvantages of the conventional impression making, the acceptance, and comfort especially in young orthodontic patients is higher with digital impressions.⁸ Students also reported preference for the digital technique and hence implementing digital intra-oral impression technique into undergraduate training is recommended.⁹

Banding of Molars

In routine clinical practice, direct bonding of the anterior teeth is followed. However, molars are often banded considering the fact that the failure rates are lower than that of bonded attachment and taking into account the anchorage demand.¹⁰ Although zinc phosphate was used initially, glass ionomers are currently in practice because of their antimicrobial activity and fluoride release.

Recently, resin-incorporated glass ionomers (GIC) creating "hybrid" cement are more preferred because of its decreased moisture contamination and increased strength. Resin-modified glass ionomers (RMGIC) setting through an acid-base reaction, with or without polymerization have also proved to prevent enamel demineralization adjacent to orthodontic bands.¹¹ Hence, the usage of RMGIC is preferred over conventional GIC for the banding of molar teeth. RMGIC is also available in a self-adhering paste system in a convenient automix syringe which offers ease of application.

Bonding/Re-bonding

Bonding in orthodontics is an unavoidable procedure with the exception of aligner therapy. Nevertheless, the technique and appliance of choice can be altered. Light-cured resin-modified glass ionomer cement can be used without any prior enamel preparation such as polishing, etching, or drying since this reduces the need for an absolutely dry field. Self-etch primers can also be used without prior enamel preparation and etching, but they require the smear layer to be removed before use, usually by pumicing or polishing teeth, which would be categorized as an AGP. A dry cotton roll/chip blower to clean the enamel surface instead of a 3-way syringe serves as a good alternative.

Indirect bonding is another alternative method that could be employed. However, the flash removal must be performed with utmost caution. Self-ligating brackets are a good replacement for conventional brackets offering better hygiene since the

elastomeric ties are avoided and also offer fewer orthodontic visits reducing exposure to contaminants.

Gange¹² has proposed certain guidelines for orthodontic technique in JCO 2020 which can also be adopted.

Debonding

The use of high-speed air turbines with coolant water during the adhesive material removal increases the amount of aerosol contamination in and around the operatory area. Hence barrier equipment is necessary during debonding.¹³ Aerosol particulates produced during enamel clean-up might be inhaled irrespective of hand-piece speed or the presence or absence of water coolant. These particulates will most likely deposit in the conducting airways and terminal bronchi of the lungs which will be cleared by the mucociliary escalator while some are likely to be deposited in the terminal alveoli and cleared after weeks or months.¹⁴ Hence the usage of high-speed aerators must cease forthwith. Scraping of the adhesive remnant with a hand scaler serves as a valuable alternative.

Bakry et al.¹⁵ in 2019 have invented a method for debonding orthodontic metal brackets with eugenol emulgel. It claims to reduce Vickers hardness of the dental resin thereby decreasing the debonding force and hence the throw of the remnants. Laser debonding is an effective alternative however the adhesive remnant index (ARI) did not show statistical significance in the remnant present after debonding. The amount of enamel damage was found to be lesser with laser debonding.

Grünheid et al.¹⁶ studied the in vitro effects of elimination of the need to clean up excessive adhesive upon debonding of a new flash-free adhesive (APC Flash-Free Adhesive Coated Appliance System, 3M Unitek [3M], Monrovia, California, USA). It was concluded that the amount of adhesive remnant on the tooth surface was similar to the conventional adhesive. However, there was a noticeable trend toward shorter adhesive remnant clean-up time with the flash-free adhesive, despite a larger amount of adhesive remaining after debonding.¹⁶

Plaque Removal

Plaque deposition in patients undergoing orthodontic therapy is increased compared with non-orthodontic patients and is not influenced by age, gender, or duration of orthodontic treatment.¹⁷ Conventionally, ultrasonic cleaners are used for plaque and calculus removal. In a pilot study, it was determined that the aerosol contamination during ultrasonic scaling was found on the head, chest, and inner surface of the face mask of the operator and the assistant. It was also determined that the aerosol was retained in the air for up to 30 minutes after scaling.¹⁸

Commercially available focused spray ultrasonic inserts promises to have lesser aerosol generation. However, this has to be combined with high-volume evacuators and adequate ventilation. A more cost-effective method to decrease aerosol generation is to use hand scalers for the removal of plaque and calculus.

Bracket Recycling

Bracket recycling can be done by chemical, thermal, or mechanical methods. It is generally carried out through the process of sandblasting using aluminum oxide or heating over a bunsen flame or a combination of both. This can also be followed by immersion of the brackets in an acid bath containing hydrochloric acid and nitric acid. Silica coating with aluminum trioxide particles followed by silanization is also a proven method for bracket recycling. All of these methods result in aerosol generation during recycling and hence they have to be carried out with utmost caution.

The use of erbium: Yttrium aluminum garnet (Er:YAG) laser was found to be the most efficient method for recycling followed by sandblasting, thermal, and tungsten carbide methods.¹⁹ For ceramic brackets, both Er:YAG laser and sandblasting were found to be efficient with Er:YAG laser having the advantage of not changing the design of the bracket base while removing the remnant adhesive.²⁰ The shear bond strength of repeated recycled brackets using sandblasting was found to be the same and there were not many changes in the morphology of the bracket base/slot dimensions.²¹ However, using lasers, there was incomplete removal of the adhesive from repeated recycled brackets along with flattening and distortion, and hence it is preferred to use a new bracket in case of second bond failure.²²

Acrylic Appliances

Acrylic appliances should initially be cleansed thoroughly underwater and then disinfected using hydrogen peroxide or Corega tablets. Simple fitting and adjustments of the removable appliances are not classified as an AGPs and hence it does not need any special care.

Trimming of the acrylic appliance generates aerosol and hence it should be carried out in high-risk procedure rooms after decontamination. It should be performed using a slow-speed motor with caution since the acrylic particles act as a carrier for virus transmission. It is rinsed again before re-insertion.

Extractions and Disimpactions

Extractions especially for orthodontic purposes are unavoidable treatment procedures. They have to be carried out with maximum precaution. Single-visit extractions have been recommended to reduce patient exposure as much as possible.

Disimpaction of teeth involves surgical exposure of the impacted teeth followed by bonding of a bracket or an attachment to the exposed teeth. Disimpaction can be performed either as an open technique or a closed technique. Whichever technique is to be adopted; the above-mentioned bonding protocols must be followed strictly.

Clear Aligner Therapy

Clear aligner therapy stands a better place especially during the pandemic in being the orthodontic therapy that provides the least number of in-patient appointments.²³ It was determined from a questionnaire study that the fixed appliances produced major emergency conditions during the pandemic requiring

tele-orthodontics.²⁴ It was determined that the Whatsapp web was considered a good method of communication for the patients during the pandemic.²⁵ To kick off with the digital impression making, the chairside time, and cross-contamination are majorly reduced with the aligners. A review by Kaur et al.²⁶ concluded that the clear aligner therapy offers a clear advantage over the fixed labial/lingual appliance distinctly during the pandemic. Nevertheless, it cannot be suited for all cases with some requiring fixation of auxiliaries such as attachments, intermaxillary elastics, etc.

Inter-proximal Reduction

Interproximal reduction using burs generates aerosol production and hence IPR strips should be used instead of burs and discs. Low-speed airtors can be employed as an alternative. However, they should also be carried out in a high-risk procedure room with maximum protection.

Retention

Orthodontic retention is one of the most important benchmarks in achieving successful treatment results. Usually, fixed lingual retainers are more preferable than removable retainers, especially in the mandibular arch. However, it has been suggested that both types of retainers are associated with gingival inflammation and elevated plaque scores. But the alignment is maintained in place better with fixed lingual retainers.²⁷

Considering the current situation to reduce the contact time of the patient and prevent contamination, an Essix retainer, Hawley's retainer, or any other type of removable retainer is preferred over bonded lingual retainers. It is recommended to provide additional pairs of retainers to the patients to reduce patient exposure in case of loss or damage.

Use of Rubber Dam

In orthodontics, the usage of rubber dams is very limited. Previous studies have shown the application of rubber dam usage during

debonding to prevent aspiration of the debonded fragments.²⁸ Now that it has been established that the coronavirus is said to be laden in the salivary glands for as much as 29 days, further use of isolation techniques using rubber dams especially during bonding can be further explored.

Post-orthodontic Clean-up

Post-orthodontic clean-up of the operatory is an important regimen to follow. Patients should be advised to leave the unit immediately after their appointment. The next appointment should be spaced effectively to allow time for sanitization and disinfection of the operatory. For floor disinfection, a 2 step cleaning procedure must be employed. Detergent and freshly prepared 1% sodium hypochlorite with a contact time of 10 minutes after any patient/ major splash or 2 hour to be done for the entire working area.

Freshly prepared 1% sodium hypochlorite before starting daily work, after every procedure and after finishing daily work on the rest of the surfaces. Delicate Electronic equipment should be wiped with an alcohol-based rub/spirit (60-90% alcohol) swab before each patient contact. For sterilization of orthodontic pliers, steam autoclave sterilization, ultrasound bath, and thermal disinfection or disinfection with chemical substances 2% glutaraldehyde or 0.25% Peracetic acid (PAA) can be done.

Orthodontic markers can either be autoclaved or disinfected using glutaraldehyde solution. Cleaning photographic retractors with a washer-disinfector is recommended. Flushing dental unit water lines for at least 2 minutes or using disinfectants improves the quality of water within the dental unit and minimizes the risk of infection. Numerous studies have demonstrated that mechanical methods such as the use of filters and drying of the dental unit waterline (DUWL) overnight are very effective mechanisms. Chemical methods such as the use of Dioxiclear and MicroCLEAR were found to be the most effective in treating the contamination.²⁹

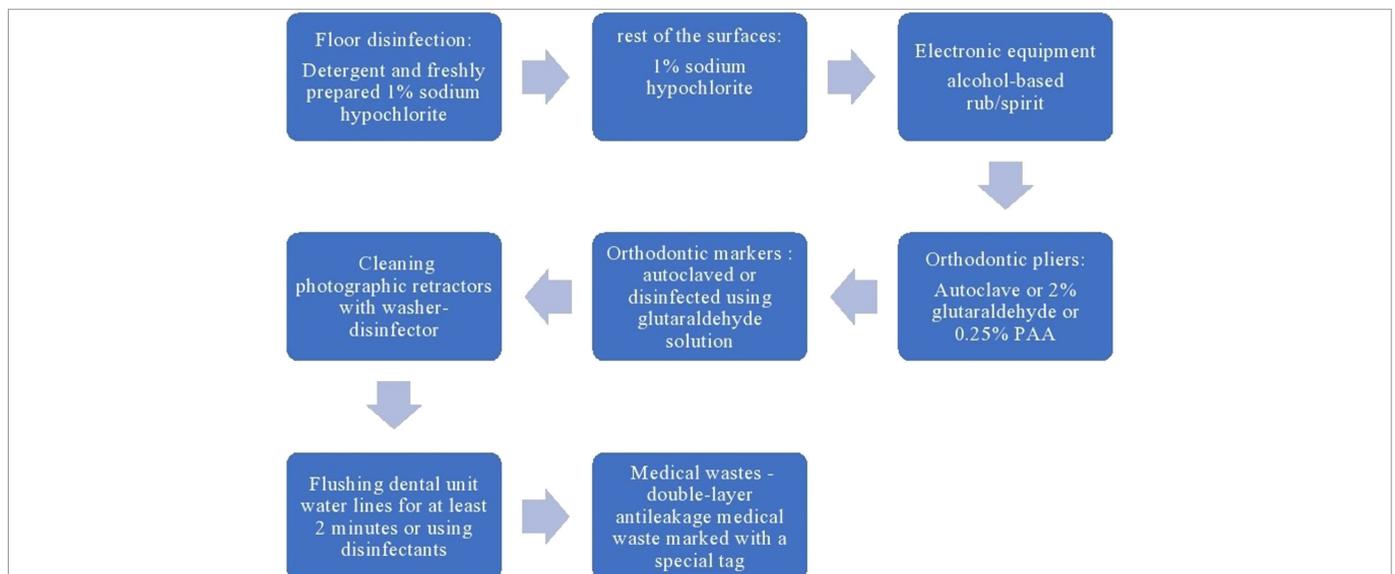


Figure 4. Post-orthodontic clean-up

Medical wastes should be handled as infectious medical wastes. A double-layer antileakage medical waste marked with a special tag is recommended (Figure 4).

CONCLUSION

Although symptomatic patients have been the main source of transmission, asymptomatic patients and patients in the incubation period still serve as carriers. Since the salivary glands act as a reservoir for the virus as long as 29 days after infection, the potential for the spread of infections from patients to dentists or dental assistants is high. Let us all remember that the circumstances are beyond control, but our conduct is in our own power. Thus, emphasis and commitment toward a strict protocol and adaptation to the "new normality" are mandatory for the prevention of the disease.

At the end of the day, the goals are simple: safety and security!

Let us all fight the virus together but not too close!

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REFERENCES

- Guo YR, Cao QD, Hong ZS, et al. The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID19) outbreak: an update on the status. *Mil Med Res*. 2020;7(1):11. [CrossRef]
- Giovanetti M, Benvenuto D, Angeletti S, Ciccozzi M. The first two cases of 2019-nCoV in Italy: where they come from? *J Med Virol*. 2020;92(5):518-521. [CrossRef]
- Paraskevis D, Kostaki EG, Magiorkinis G, et al. Full-genome evolutionary analysis of the novel corona virus (2019-nCoV) rejects the hypothesis of emergence as a result of a recent recombination event. *Infect Genet Evol*. 2020;79:104212. [CrossRef]
- Bizzoca ME, Campisi G, Lo Muzio LL. COVID-19 pandemic: what changes for dentists and oral medicine experts? A narrative review and novel approaches to infection containment. *Int J Environ Res Public Health*. 2020;17(11):3793. [CrossRef]
- Suri S, Vandersluis YR, Kochhar AS, Bhasin R, Abdallah M-N. Clinical orthodontic management during the COVID-19 pandemic. *Angle Orthod*. 2020;90(4):473-484. [CrossRef]
- Turkistani KA. Precautions and recommendations for orthodontic settings during the COVID-19 outbreak: a review. *Am J Orthod Dentofacial Orthop*. 2020;158(2):175-181. [CrossRef]
- Peng X, Xu X, Li Y, et al. Transmission routes of 2019-nCoV and controls in dental practice. *Int J Oral Sci*. 2020;12(1):9. [CrossRef]
- Mangano A, Beretta M, Luongo G, Mangano C, Mangano F. Conventional vs digital impressions: acceptability, treatment comfort and stress among young orthodontic patients. *Open Dent J*. 2018;12:118-124. [CrossRef]
- Schott TC, Arsalan R, Weimer K. Students' perspectives on the use of digital versus conventional dental impression techniques in orthodontics. *BMC Med Educ*. 2019;19(1):81. [CrossRef]
- Nazir M, Walsh T, Mandall NA, Matthew S, Fox D. Banding versus bonding of first permanent molars: a multi-centre randomized controlled trial. *J Orthod*. 2011;38(2):81-89. [CrossRef]
- Kashani M, Farhad S, Rastegarfar N. Comparison of the effect of three cements on prevention of enamel demineralization adjacent to orthodontic bands. *J Dent Res Dent Clin Dent Prospect*. 2012;6(3):89-93.
- Gange P. Bonding in the COVID-19 era. *J Clin Orthod*. 2020. (Available at: [CrossRef]), Accessed May 11, 2020.
- Torog SM, Haytac C, Ko'ksal F. Evaluation of aerosol contamination during debonding procedures. *Angle Orthod*. 2001;71:299-306.
- 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(1):11-17. [CrossRef]
- Bakry ASI, Abbassy MA, Linjawi, Amal H, Ali H. Method for debonding of orthodontic metal brackets with eugenol emulgel. 2019. United States Patent Application Publication 2017.
- Grünheid T, Sudit GN, Larson BE. Debonding and adhesive remnant cleanup: an in vitro comparison of bond quality, adhesive remnant cleanup, and orthodontic acceptance of a flash-free product. *Eur J Orthod*. 2015;37(5):497-502. [CrossRef]
- Memon AB, Jabbar A, Shaikh IA, et al. Plaque score during orthodontic treatment in relation to age and gender. *J Pak Dent Assoc*. 2015;24(2):100-103.
- Veena HR, Mahantesha S, Joseph PA, Patil SR, Patil SH. Dissemination of aerosol and splatter during ultrasonic scaling: a pilot study. *J Infect Public Health*. 2015;8(3):260-265. [CrossRef]
- Chacko PK, Kodoth J, John J, Kumar K. Recycling stainless steel orthodontic brackets with Er:YAG laser: an environmental scanning electron microscope and shear bond strength study. *J Orthod Sci*. 2013;2(3):87-94. [CrossRef]
- Yassaei S, Aghili H, Firouzabadi AH, Meshkani H. Effect of Er:YAG laser and sandblasting in recycling of ceramic brackets. *J Lasers Med Sci*. 2017;8(1):17-21. [CrossRef]
- Bahnasi FI, Rahman ANAA, Abu-Hassan MI. The impact of recycling and repeated recycling on shear bond strength of stainless steel orthodontic brackets. *Orthod Waves*. 2013;72(1):16-22. [CrossRef]
- Alawy SBM, El Shourbagy EM, Ghobashy SA. The effect of recycling and repeated recycling with Er:YAG laser on shear bond strength and surface characteristics of stainless steel orthodontic brackets. *Egypt Dent J*. 2017;63(107):116.
- Marya A, Venugopal A, Vaid N, Alam MK, Karobari MI. Essential attributes of clear aligner therapy in terms of appliance configuration, hygiene, and pain levels during the pandemic: a brief review. *Pain Res Manag*. 2020;2020:6677929. [CrossRef]
- Bustati N, Rajeh N. The impact of COVID-19 pandemic on patients receiving orthodontic treatment: an online questionnaire cross-sectional study. *J World Fed Orthod*. 2020;9(4):159-163. [CrossRef]
- Caprioglio A, Pizzetti GB, Zecca PA, et al. Management of orthodontic emergencies during 2019-nCoV. *Prog Orthod*. 2020;21(1):10. [CrossRef]
- Kaur H, Kochhar AS, Gupta H, Singh G, Kubavat A. Appropriate orthodontic appliances during the COVID-19 pandemic: a scoping review. *J Oral Biol Craniofac Res*. 2020;10(4):782-787. [CrossRef]
- Al-Moghrabi D, Johal A, O'Rourke N, et al. Effects of fixed vs removable orthodontic retainers on stability and periodontal health: 4-year follow-up of a randomized controlled trial. *Am J Orthod Dentofacial Orthop*. 2018;154(2):167-174.e1. [CrossRef]
- Chate RAC. Safer orthodontic debonding with rubber dam. *Am J Orthod Dentofacial Orthop*. 1993;103(2):171-174. [CrossRef]
- Wirthlin MR, Roth M. Dental Unit Waterline Contamination: a review of research and findings from a clinic setting. *Compend Contin Educ Dent*. 2015;36(3):216-219.