

nCoV-19 Pandemic: Background on Coronavirus, Clinical Management of Orthodontic Patient and Emergency Orthodontic Care During Covid-19 Crisis

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ABSTRACT

Background: Most recently, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and its associated coronavirus disease have held the world and cause widespread globally. The disease outbreak is still on the rise because of the community spread pattern of this infection. It is one kind of zoonotic infection, assumed to be originated from bats and pangolins and later it's transmitted to a human. This coronavirus (SARS-CoV-2) is abundantly present in nasopharyngeal and salivary secretions of affected patients, and its spread is predominantly thought to be respiratory droplet/contact in nature. Many studies reported that dental professionals are profoundly affected than other professionals. This article briefly explains the background of coronavirus and its impact on the orthodontist and management of orthodontic patients during this COVID crisis.

Keywords: COVID 19, orthodontic management, pandemic.

INTRODUCTION

A novel β -coronavirus (2019-nCoV) caused severe and fatal pneumonia probed in a seafood market of Wuhan city, Hubei province, China, and rapidly spread to many countries. Since December 2019 its outbreak is high in other countries and our country. The permanent solution for this outbreak is still unknown. The dental professionals are at high risk compared to other professionals. Dental professionals should be familiar with how 2019-nCoV is spread, how to identify patients with 2019 nCoV infection, and what extra protective measures should be adopted during the practice, in order to prevent the transmission of 2019-nCoV¹. Due to this pandemics, orthodontist and patient undergoing orthodontic treatment were highly

affected because it is one of the long time treatment in dental practice. The patients affected because of unscheduled appointments, expensive treatment, patients may not be able to handle if an emergency situation like a broken appliance. This review explains the background of coronavirus and clinical orthodontic management in this pandemics with the currently available data.

BACKGROUND OF PANDEMIC

Origin and when did the outbreak starts ?

December 30 2019-Wuhan, Hubei province, China, became the centre of an outbreak of pneumonia of unknown cause.

Received: Jan. 22, 2020; Accepted: Mar. 24, 2020

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January 7 2020- Chinese scientists had isolated a novel coronavirus (nCoV) from patients in Wuhan

January 16 2020-The first case was reported in Japan

January 16 2020- The confirmed cases were consecutively reported in 32 provinces, municipalities, and special administrative regions in China, including Hong Kong, Macau, and Taiwan

January 19 2020-The first case was reported in Korea and two cases in Beijing and one case in Guangdong

January 30 2020-The first case was reported in India²⁻⁵

CORONAVIRUSES

Coronaviruses (CoVs) (order Nidovirales, family Coronaviridae, subfamily Coronavirinae) are enveloped viruses and single-stranded RNA genome. Coronavirus virions are spherical, and their surface appears crown-like, due to spiked glycoprotein projections so its called as the corona. Its genome sizes ranging from 26 to 32 kilobases (kb) in length, CoVs have the largest genomes for RNA viruses. CoVs have been divided into three groups: α -CoVs, β -CoVs, and γ -CoVs based on genetic and antigenic source^{6,7}. (Figure 1 -schematic presentation)

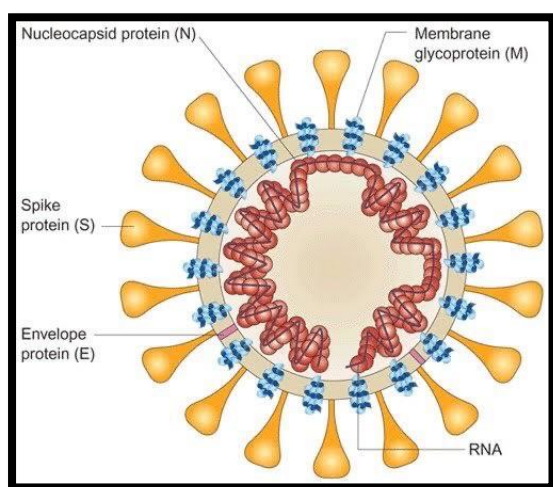


Fig 1: Schematic diagram of the SARS coronavirus structure (Peiris JS et al. 2003)¹⁹

ROUTE OF TRANSMISSION

It is a type of zoonotic infection where it primarily infects birds and mammals, causing a variety of lethal diseases. They can also infect humans and causes upper respiratory tract infections (URTIs) resembling the common cold and lower respiratory tract infections (LRTIs) such as bronchitis, pneumonia, and even severe acute respiratory syndrome (SARS)⁸. COVID-19 spread worldwide due to travel and on March 11 2020, the WHO declared COVID-19 as a pandemic. The nCoV-19 is considered to be transmitted primarily through respiratory secretions and direct person to person contact. This virus might be seen in the saliva of infected patients which means it can be transmitted through oral fluids of the infected person to others like sneezing, coughing etc. The contact transmission, droplet transmission (Figure 2) and person to person transmission are different modes of transmission of nCoV⁹.

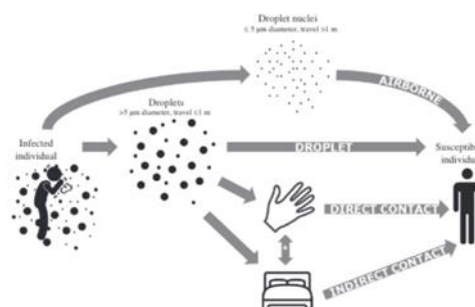


Fig 2: Transmission route (Otter JA et al)¹⁰

Although the potential route is through the respiratory route. Most recent studies have explained various routes of SARS-CoV-2 like blood, saliva, and faecal swabs^{11,12}

INCUBATION PERIOD:

The incubation period of SARS-CoV-2 is 1–14 days, mostly 3–7 days, and the COVID-19 is contagious during the latency period. It is highly transmissible in humans, especially in the elderly and people with underlying diseases. The median age of patient is 47–59 years, and 41.9–45.7% of patients were females. COVID-19 patients present with symptoms such as fever, malaise and cough. Most adults or children with

SARS-CoV-2 infection presented with mild flu-like symptoms and a few patients are in critical condition and rapidly develop acute respiratory distress syndrome, respiratory failure, multiple organ failure and even deaths.^{13,14,15}

The patients are considered to be in convalescence when they present with the following symptoms: (1) Normal temperature for more than 3 days, (2) Resolved 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.^{16,17,18}

LIFE SPAN

The coronaviruses have been reported to remain infectious on inanimate surfaces in the range between 2 hours to 9 days. Van Doremalen N et al. 2020 conducted study on the data consisted of two viruses (SARS-CoV-2 and SARS-CoV-1) in five different environmental conditions (aerosols, plastic, stainless steel, copper, and cardboard)¹⁹. All experimental objects and report are as follow copper (4 hours), cardboard (24 hours),plastic (6.8 hours), stainless steel (5.6 hours) and aerosol (3 hours).

CLINICAL MANIFESTATION

The common symptoms at the onset of illness were fever (40 [98%] of 41 patients), cough, and myalgia or fatigue. other common symptoms were sputum production, headache, haemoptysis, and diarrhoea. More than half of the patients developed dyspnoea. The median duration from illness onset to dyspnoea reported was 8 days ^{20,21}. Other severe complications are respiratory distress syndrome, multiorgan failure, shock, and cardiac arrhythmias and can even lead to death based on the age of the individuals.^{22,23}. The population at risk included older individuals with comorbidities like diabetes mellitus, hypertension, asthma, chronic obstructive pulmonary diseases and cardiac illness.

LABORATORY TEST FOR COVID-19

A complete blood count, coagulation profile and serum biochemical test (including renal and

liver function, creatine kinase, lactate dehydrogenase, and electrolytes) can be taken. Respiratory specimens including nasal and pharyngeal swabs, bronchoalveolar lavage fluid sputum or bronchial aspirates were tested for common viruses including influenza, avian influenza, respiratory syncytial virus, adenovirus, parainfluenza virus, SARS-CoV and MERS-CoV using real-time RT-PCR assays approved by the China Food and Drug Administration. Routine bacterial and fungal examinations were also performed. Repeated tests for 2019-nCoV were done in patients confirmed to have 2019-nCoV infection to show viral clearance before hospital discharge or discontinuation of isolation.

Most common laboratory finding includes,

- Increased prothrombin time
- Lymphopenia
- Raised lactate dehydrogenase
- Mild elevation of inflammatory markers like CRP and ESR.

CHEST X-RAY FINDINGS

In radiology, many kinds of literature up to date has focused on chest CT manifestations of COVID-19 includes lung consolidation and ground-glass opacities. The peripheral lung opacities also tend to be multifocal, either patchy or confluent and can be readily identified. Diffuse lung opacities in patients with COVID-19 have a similar CXR pattern as like other widespread infectious or inflammatory processes including acute respiratory distress syndrome (ARDS)^{24,25}.

TREATMENT

Although no antiviral treatments have been approved, several approaches have been proposed such as lopinavir/ritonavir (400/100 mg every 12 hours), chloroquine (500 mg every 12 hours), and hydroxychloroquine (200 mg every 12 hours). Alpha-interferon (e.g., 5 million units by aerosol inhalation twice per day) is also used.

In Italy, a significant investigation led by the Istituto Nazionale Tumori, Fondazione Pascale di Napoli is focused on the use of tocilizumab. It

is a humanized IgG1 monoclonal antibody, directed against the IL-6 receptor and commonly used in the treatment of rheumatoid arthritis.²⁶

The use of corticosteroids for severe ARDS is still controversial. So needs to be cautious when we use glucocorticoids. Methylprednisolone can be used as appropriate for patients in case of rapid disease progression or severe illness. According to the severity of the disease, 40 to 80 mg of methylprednisolone per day can be considered and the total daily dose, it should not exceed 2 mg/kg (*Weak recommendation*).²⁷

PREVENTIVE CARE

Preventive strategies are focused on the isolation of patients and careful infection control, including appropriate measures to be adopted during the diagnosis and the provision of clinical care to an infected patient. For instance, droplet contact and airborne precautions should be adopted during specimen collection and sputum induction should be avoided.

The WHO and other organizations have issued the following general recommendations:

- Avoid close contact with subjects who suffers from acute respiratory infections.
- Wash your hands frequently
- Avoid unprotected contact with farm or wild animals.
- People with symptoms of acute airway infection should keep their distance, cover coughs or sneezes with disposable tissues or clothes and wash their hands.
- Immunocompromised individuals are prone to get infected and avoid public gatherings is much needed ²⁸⁻³¹.

GLOBAL DENTAL PRACTICE-PREVENTIVE MEASURES

Prevention is better than a cure however ,although we are following routine precautionary measures to control transmissions .Sometimes, Few armamentaria required to prevent further transmission of infection and those is as follow.

1. Automatic Hand Sanitiser Dispenser



Fig 3: Picture courtesy-Internet

The touch-free delivery with sensor attached hand sanitiser dispenser eliminates cross-contamination, and it helps to reduce the spread of infection the routine manual method increases the chance of infection compared to an automatic dispenser. Figure 3(picture courtesy: internet)

2. Non-Contact Infra Red Thermal Device :-



Fig 4: Picture courtesy -internet

Patient reporting to the dental clinics may or may not shows typical features of covid 19. In such cases, the use of the non-contact infra-red device for measuring a person's temperature considers as one of the ideal methods. (NCITs). NCITs may be used to reduce the risk of cross-contamination and minimize the risk of spreading disease. (Figure 4)

3. N99 face mask with Filtering facepiece Respirators



Fig 5: Courtesy -Internet.

In 1972, 3M introduced the first single-use N95 mask for industrial coal workers. NIOSH-Approved Particulate Filtering Facepiece Respirators³²(Figure 5). This type of air-purifying respirators protects by filtering particles out of the air when the user is breathing. There are seven classes of filters for NIOSH-approved filtering facepiece respirators available at this time. Ninety-five per cent is the minimal level of filtration that will be approved by NIOSH. It is otherwise known as a respiratory mask and its made up of millions of microfibrils of polypropylene layers where its outer layer is electrostatically charged. The electrical charge is used to retain its ability and to filter microorganism.

4. Personal protection kit :

Personal Protective Equipments (PPEs) are protective gears designed to safeguard the health of workers by minimizing the exposure to a biological agent. ³³There are various design available depends on the type of uses it needed .It is mandatory to use in health care to prevent the spread of transmission . Components of PPE are goggles, face-shield, mask, gloves, coverall/gowns (with or without aprons), headcover and shoe cover.

5. Hazmat Suit

The hazardous materials suit is a piece of personal protective equipment that consists of an impermeable whole-body garment worn as protection against hazardous materials. The hazmat suit generally includes breathing air supplies to provide clean, uncontaminated air for the wearer. In laboratory use, fresh air may

be supplied through attached hoses. This air is usually pumped into the suit at positive pressure with respect to the surroundings as an additional protective measure against the introduction of dangerous agents into a potentially ruptured or leaking suit.

ORTHODONTIC MANAGEMENT OF nCOV-19 PANDEMIC

Due to this pandemic, routine dental treatment suspended whereas only emergency dental treatment can be provided. An orthodontic emergency might be described as a problem arising from an orthodontic appliance, where an unscheduled appointment is required to resolve the issue. Patients who possess an orthodontic emergency may be experiencing pain or discomfort^{34,35}. Continuous breakages of the appliances may lead to increased treatment time and patient motivation gradually reduces due to a loss of confidence over the operator.

Orthodontists must be aware of the available evidence to provide a safe environment for themselves, their patients and patient family members and the entire orthodontic team. The most up-to-date recommendations and clinical guidelines from health organisations, state government guidelines and local public health authorities is mandatory for all orthodontist to handle emergency situation in this corona crisis.

PATIENT MANAGEMENT

1. Most orthodontic appliances can be left in place for some months without affecting to the patient if the patient strictly adhere to the oral hygiene instruction given by the orthodontist³⁶.The oral hygiene instructions are
 - Exemplary oral hygiene measures – brushing 3 times a day with their standard toothbrush, followed by other dental aids like interproximal brush can use . As an adjunct , use of a fluoride mouthrinse (225ppm), once a day.³⁶
 - Low sugar diet – Advice patient to avoid all snacking loaded with sugar and drinks with

added sugar. Especially , fizzy drinks should be avoided ³⁶

- The hard, sticky foodstuffs that could break the brace wire or bracket attached to the tooth should be avoided.³⁶
- 2. Patients should also be instructed to always wash their hands regularly prior to and after placing and removing appliances or elastics, to clean their appliances regularly by wiping with alcohol and advice to store appliances properly ³⁷.
- 3. Teledentistry in orthodontics:
 - Ask relevant history including travel history to the covid affected region
 - Ask any presence of fever, shortness of breath, cough, and Loss of smell taste.
 - Any positive response to the above questions should raise a concern and elective care should be postponed for three weeks.
- 4. Favero *et al.* stated that minor emergencies like rubber ligature displacement, pain or discomfort due to the appliance, irritation of cheeks can be solved easily at home, reassuring patient and parents on one hand and limiting visits to the dental office to cases of real need.^{38,39}Through telecommunication, we can identify type of problem the orthodontic team speak to the patient or parent (either immediately or at a later agreed time) to identify the problem and determine if a visit to the clinic is essential.

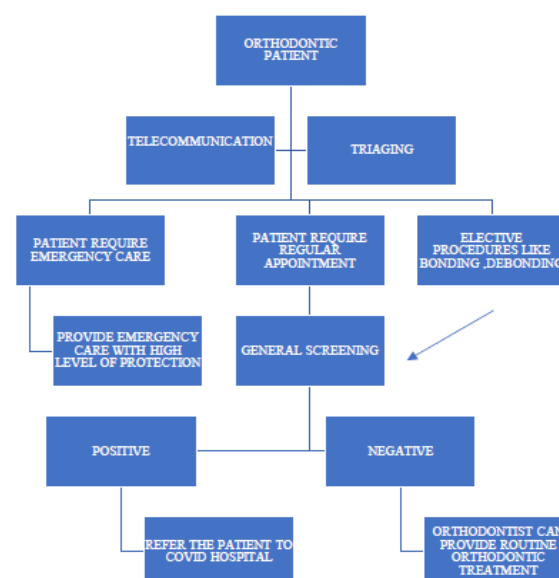
Table 2: Classification of an orthodontic emergency.

Critical Cases	1. The fixed appliances or it is component injuring soft tissues, 2. Dislodged components like loose molar bands 3. TADS ,Class II correctors which are likely to be ingested or inhaled. 4. Presence of abscess
Semi critical Cases	Non-Removable appliances which patient can activate by its own eg Facemask,headgear,lip bumpers,Expansion appliances
Non-critical Cases	Functional Appliances ,aligners retainer if broken or does not fit.

- Are they in pain?
- What is the problem?
- Can the patient deal with the problem at home ?

After receiving a summary of the problem ,its necessary to find out any medical issue and patients are advised to take a photo of the problem can be sent to the orthodontist. Then, advice can be given over voice call /video call whichever possible.

Orthodontic patient management algorithm



EMERGENCY ORTHODONTIC CARE

Classification of an orthodontic emergency

Based on the type of appliances, Orthodontic emergency can be classified into three category

MANAGEMENT OF ORTHODONTIC EMERGENCIES AT HOME

From an orthodontic viewpoint, orthodontic emergencies condition includes embedment of an orthodontic appliance into the soft tissue like gingiva, oral mucosa which leads to severe pain

and or infection, circumstances related to dental trauma or few conditions where a lack of management would be harmful to the patient. In order to deal with this, certain contingency plan has to be formulated by the orthodontist and given in the following tabulation.

Table 2: Orthodontic Problem And its Management of Orthodontic Problem at home.^{34,35,36,40-43}

S.no	ORTHODONTIC PROBLEM	MANAGEMENT
1.	Irritation of lip and/or cheek from the brackets	- Orthodontic relief wax is a good momentary solution. - Orthodontic wax that is accidentally swallowed is harmless - Relief wax can be placed over the bracket or long wire that is causing the irritation. - Advice topical anaesthesia over the ulcerated areas.
2.	Wires digging in	- Thin wire- It may be possible for the patient or family member to use tweezers to replace wire in the tube/band or tweezers and ask patient to use nail clipper/scissors to shorten the long end. - Advice them to push the wire back round in order to prevent the long end digging in. - Thick and stiff wire- It may not be possible to cut the wire with home instruments. If this is the case it may be necessary to advice patient to cover end of the wire with wax.
3.	Loose elastic chain	Advice patient to break it with sterile tweezer or sterile clipper
4.	Elastic ligature has come out	Guide the patient to put ligature around bracket, with the help of tweezer
5.	Problem with metallic ligature	- If it is loose, ask them to remove it with the help of tweezer - If it is broken half and tightly adhered to bracket, It can be blend over bracket with the help of cotton bud or clean pencil eraser .
6	Orthodontic attachment-Loose brackets	- Guide via video on how to remove the bracket from the wire if it is causing pain or discomfort. - It may be the possible to leave the bracket if it is not causing any problems at present.
7	Orthodontic band came off	- If band is very loose , advice patient to seek orthodontist help for removal of the band and trimming of the wire depending upon your stage of treatment. - In some cases , advice them to leave the band in place. If this occurs please ensure if they adhere to good oral hygiene and a low sugar diet to prevent decay under the band and around their tooth.
8	Separators	Advice patient to remove it with end of small paper clip or wooden tooth pick

9	Temporary anchorage Devices TADS	• If it came out or loose, advice patient to seek orthodontist advice to remove springs or elastic chain which connects temporary anchorage device to the tooth structure.
10	Broken bonded retainer	• Completely broken- the patient should be advised to wear their removable retainer until their next visit with the orthodontist when the clinic/practice reopens for routine treatment. • Loose resin pad -manage patient to push the loose retainer wire back towards its tooth as much as possible or cut the exposed unbonded part of the retainer using a sterile clipper • Resin pad attached in less number of teeth, ask patient to use sterile tweezer which can be used gently to pull and remove the whole retainer.
11	Problem in fixed expansion appliance or TPA or lingual arch	• If it is partially attached and still present in the mouth, ask them to maintain in the same position unless or until meet their orthodontist • The screw activation should be stopped in case of expansion appliance. • If the expander has came out completely it should be kept in a safely until consult their orthodontist.
12	Problem in Intermaxillary spring, eg, Class II corrector	• If its broken ,advice them to manage it with the help of dental floss which can be tied back to the remaining component.
13	Problem in removable retainer	• Ask patient to contact orthodontist for access to final cast and can make a new retainer remotely which can be posted out to them • If it is not possible to get a replacement retainer ask them to use 'boil in the bag' which is heat mouldable gumshield to use and wear at night to reduce the risk of relapse and prevent unwanted tooth movement. (It should be noted that these appliances aren't specifically designed to hold teeth in position so the manufacturer cannot be held responsible for any relapse)
14	Aligners	• If current aligner is in good condition, ask them to keep wearing it as much as possible • If your current aligner is broken or ill fitting, advice them to step back to their previous aligner
15	Orthopaedic appliances	• If its broken , advice patient to discontinue the treatment, until meet their orthodontist.
16	Functional appliance	• If the patient breaks the appliance or has noticeable discomfort by wearing it, suggest suspending the use of the appliance, in order to reduce emergencies that cannot be managed directly.

17	Part of appliance or a bracket is swallowed	• Small part of orthodontic appliances that are swallowed will pass through the digestive tract Unremarkably. • In the case of sudden difficulty breathing or sudden coughing following ingestion of any orthodontic appliances . • The orthodontist may advise the patient to seek clinical examination and or radiographic assessment .
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MANAGEMENT OF ORTHODONTIC EMERGENCIES AT OFFICE

Orthodontic office preparation

The emergency orthodontic treatment can be given in a safe manner by following the general guidelines in the orthodontic office are given below.

- Check the temperature of the patient using non-contact infrared thermal device.(if possible)
- Patients only attend at the time of their appointment
- Patients must not bring other family members with them
- The seating arrangement has to be modified to provide safety measures of social distancing
- Patients should wait outside the practice until their appointment can commence
- Patients should leave the unit immediately after their appointment
- Units must make all emergency appointments long enough to ensure there is adequate time for cleaning and management of clinical waste
- Patients should wash their hands or use of hand sanitiser before entering the unit.
- Use of disposable (single-use) devices such as mouth mirror, syringes to prevent cross-contamination is encouraged

- Radiographs: extraoral imaging such as panoramic radiography or cone-beam computed tomographic imaging should be used to avoid gag or cough reflex that may occur with intraoral imaging. When intraoral imaging is used, sensors should be a double barrier to prevent perforation and cross-contamination
- Clinic staff should make sure to disinfect inanimate surfaces using chemicals recently approved for COVID-19 and maintain a dry environment to curb the spread of SARS-CoV-2
- Do not use air conditioners and provide natural ventilation wherever possible
- Preprocedural rinse with 1 % povidone-iodine along with 4 -5 drops of hydrogen peroxide for 1 minute which provide a virucidal activity for minimum three hours
- Patients with confirmed covid 19 cases have to be treated only in negative pressure theatres or airborne infection isolation room (AIIRs)

Bonding in the covid 19 crisis:-

Reliance has spent the last several weeks testing various procedures to mitigate your risk when bonding/rebonding patients during the COVID-19 crisis.^{44,45}

The bonding process has become exponentially complicated due to concern and advice to avoid high-pressure water spray and forced air. Due to new health concerns, it is advised to avoid high-pressure water spray and forced air in order to reduce aerosols.

BONDING WITH NO ADHESIVE ON ENAMEL

1. Advice patient to brush their teeth vigorously for 2 minutes with a unidose and final pumice polishing. Instruct patient to thoroughly rinse their teeth at least 3 times.
2. Blot dry thoroughly with a cotton roll
3. Acid etching with phosphoric acid for 30 seconds.
4. With the help of disposable-tip squeeze bottle filled with water. Rinse the tooth surface for 10 seconds . Blot dry thoroughly with the cotton roll .
5. Apply 1 coat of Assure Plus Unidose with a bristle brush, stroke it with several times.
6. A new dry brush used to stroke over the surface again for several times to evaporate the solvent.
7. Light cure the tooth for 10 seconds.
8. Coat a thin layer of Assure Plus to the base of the bracket and stroke over several times.
9. Apply GoTo paste to bracket base and place it over tooth and light cure.
10. Applying Assure to the bracket base is an optional step – but suggested that overall strength is slightly compromised

REBONDING WITH RESIDUAL COMPOSITE ON ENAMEL

1. Remove composite as much as possible with adhesive-removing pliers without crazing the enamel.
2. Manually roughen the composite on the enamel with a paper disk.
3. Rinse for 10 seconds with the help of disposable-tip squeeze bottle filled with water
4. Blot dry thoroughly with a cotton roll .
5. If any residues present over enamel surface, repeat the steps for acid-etching.
6. Apply one coat of Unidose Assure Plus with a bristle brush and stroke over several times.

7. The new dry brush used to stroke over the surface again for several times to evaporate the solvent
8. Light cure the tooth for 10 seconds
9. Apply one thin coat of Assure Plus to the bracket base and stroke over several times.
10. Apply GoTo paste to the bracket base, place the bracket on the tooth surface and followed by light-cure.

These techniques were developed in order to overcome the drawback of forced air and water spray. These protocols should not be utilized after we are past the COVID-19 crisis because of reduced strength and technique sensitive.

CONCLUSION

The health care professionals have the duty to protect the public and maintain high standards of care and infection control. It is essential to address urgencies in the office, which cannot be managed through teleconsultation or patient cannot manage to do at home .The emergency care with the necessary PPE and strictly adhering to the guidelines dictated by health organisations ,state government guidelines and local public health authorities.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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