

REVIEW ARTICLE

STRATEGIES FOR OPTIMIZING INTERIM INFECTION PREVENTION IN PEDIATRIC DENTAL PRACTICE DURING THE COVID-19 RESPONSE

Authors:

Nithya Annie Thomas¹

R. Rajesh²

Nimmy Sabu³

Justin Jobe⁴

Senior Lecturer¹

Dept. of Pediatric and Preventive Dentistry
Indira Gandhi Institute of Dental Sciences
Nellikuzhi, P.O.,
Kothamangalam 686 691, Kerala

Professor and Head²

Dept. of Pediatric and Preventive Dentistry
Indira Gandhi Institute of Dental Sciences
Nellikuzhi, P.O.,
Kothamangalam 686 691, Kerala

Reader³

Dept. of Pediatric and Preventive Dentistry
Indira Gandhi Institute of Dental Sciences
Nellikuzhi, P.O.,
Kothamangalam 686 691, Kerala

Senior Lecturer⁴

Dept. of Pediatric and Preventive Dentistry
Indira Gandhi Institute of Dental Sciences
Nellikuzhi, P.O.,
Kothamangalam 686 691, Kerala

Address for correspondence:

Dr. Nithya Annie Thomas

Senior Lecturer

Dept. of Pediatric and Preventive Dentistry
Indira Gandhi Institute of Dental Sciences
Nellikuzhi, P.O.,
Kothamangalam 686 691, Kerala
E mail: nithyaannie@gmail.com

ABSTRACT

COVID-19 viral transmission via dental procedures warrant the need to execute certain specific protocols to be strictly followed to reduce the risk and spread of the infection. This narrative compe rendu scrutinizes and suggests the modification in patient management, clinical practice, introduction of devices during the COVID-19 pandemic and the road ahead with reference to pediatric dentistry.

Keywords: COVID-19 , children , infection control, pediatric dentists.

INTRODUCTION

Coronaviruses (CoVs) are members of the large family of Coronaviridae. These single chain RNA viruses range from 60-140 nanometres with projections resembling spikes on its surface.¹ These spike (S) protein attaches to angiotensin converting enzyme 2 (ACE2) receptors that is found on the surface of many human cells, including those in the lungs allowing virus entry² and causes respiratory illness in humans. Some of the lethal Coronaviridae are - Severe acute respiratory syndrome coronavirus (SARS-CoV), Middle East respiratory syndrome coronavirus (MERS-CoV).¹

In December 2019, a new variant of coronavirus that causes pneumonia was first detected in Wuhan, China. Initially, it was called as 2019 novel coronavirus (2019-nCoV). It was referred by the International committee on taxonomy of viruses as SARS-CoV-2. And the official name of the disease spread by this virus as COVID-19 as declared by WHO.³ This rapidly spreading viral disease, designated as a pandemic was declared as a Public Health Emergency of International Concern (PPHEIC) has globally affected more than 194 countries (WHO, 2020).²⁻⁵ With incredibly high morbidities and mortalities worldwide.⁶ Despite worldwide efforts to contain viral spread, the outbreak has not been stopped yet.³ The COVID-19 pandemic has had a noteworthy impact on dentistry.

Routes of transmission

The controversy on the modes of transmission of the SARS-CoV-2 virus seems to be speculating and perplexed among many researchers, including the WHO.⁶

This virus has been detected in respiratory, GI and other bodily secretions and also in air samples suggestive of chances of airborne transmission.⁷

The common route of transmission of this novel corona virus via close person-to-person contact (about 2 m) include direct transmission through coughing, sneezing, talking and droplet inhalation/exhalation and contact transmission via oral, nasal and conjunctival mucous membranes to people who do not have adequate barriers.^{4,6} Airborne

transfer through aerosols produced in dental procedures is another probable route of transmission of this virus.⁴

Another route of transmission occurs indirectly when saliva droplets fall on other surfaces, such as the ground and objects made of different materials, and people come into contact with them.⁸ There are three pathways for COVID-19 spread via saliva - from COVID-19 in the lower and upper respiratory tract that enters the oral cavity together with the liquid droplets frequently exchanged by these organs, COVID-19 present in blood can access the mouth via the gcf, and lastly, via the major or minor salivary gland infection with subsequent release of particles in saliva through the salivary ducts.³

Direct physical touch between an infected individual and susceptible host and indirect contact with infectious secretions on fomites can cause the contact transmission.⁶

There is also a concern of faecal-oral route of transmission of COVID-19. Xu et al⁹ found that majority of children with SARS-CoV-2 had persistently positive rectal swabs even after their nasopharyngeal tests were negative.

Prevention of COVID-19 among children

It is the responsibility of parents or caretakers to take the necessary precautions to prevent the disease in children. The CDC has put forth certain recommendations for prevention, which include:

1. Monitoring activities of children at home, school and outside.
2. Limit large group activities
3. Keep distance during play and interaction
4. At home and school, keep the surfaces and objects sanitized
5. Discourage group travels and outings
6. Hand hygiene must be taught to children and monitored periodically¹.

Clinical features of children with COVID 19

SARS-CoV-2 has a long incubation period of 2-14

days.⁵ The average incubation period in children is 8 days which is longer than that of adults.⁴ The explanation why COVID-19 is less severe in children as compared to adults is still confusing. Proposed elucidations include:

1. Children have a more active innate immune response
2. Healthier respiratory tracts as they have not been exposed to as much cigarette smoke or air pollution as adults
3. Fewer underlying diseases
4. Weaker ability to trigger an acute inflammatory response to SARS-CoV-2.³ Markers of pro-inflammatory response like C-reactive protein is uncommon in children which is suggestive of reduced inflammatory response to infections in children.
5. Reduced expression of Angiotensin Converting Enzyme-2 (ACE-2) receptor which is necessary for the virus to secure.¹

The most prevalent symptoms are fever, dry cough, nasal symptoms, fatigue upper respiratory tract infection GI symptoms like anorexia, diarrhoea, nausea/vomiting. The nasal symptoms are runny nose and nasal congestion. However, symptoms of loss of smell are usually not present. It rarely progresses to lower respiratory tract infections. Other symptoms like hyposmia and dysgeusia have also been reported. With emerging cases of COVID-19 in children, a recent trend of Kawasaki like disease also called as Multisystem Inflammatory Syndrome (MIS-C) has been noted. It usually manifests itself 3-4 weeks after the child recovers from SARS-CoV-2 infection and develops antibodies against the virus.¹

Overall, the prognosis of COVID-19 is good in children and mortality rate is lower than in adults; of 0.01%.^{1,7}

Risk of Infection in a pediatric dental setting

Dental procedures are focal points for cross infection⁵ - because of aerosol production, handling of sharp instruments and close proximity of the patient while carrying out dental treatments. A

DHCP is categorised in very high exposure risk category as reported by OSHA as in a dental setting, there is risk of contamination via numerous sources - bioaerosols, splatter, droplets, salivary secretions, debris and blood. These could be sources of dissemination of acute respiratory infections. A salivary gland could be a major source of the community based viral transmission of COVID-19 by asymptomatic infections originating from infected saliva. Splatter comprises of a mixture of air, water, solids coupled with bacteria, virus, fungi posing as a biological risk to the dental health personnel.¹¹ Bioaerosols are suspension of biological fragments in gaseous media which possibly is produced by powered dental instruments.⁷

Since children can be asymptomatic or present with mild/moderate non-specific symptoms, all child patients and their guardians should be considered as potentially infected and thus carriers of COVID-19 unless contrary is proved.^{3,5} Additionally, dental offices have a greater number of potentially infected/contaminated surfaces - dental chairs, spittoon, handles, dental instruments etc. SARS-CoV-2 can survive on these surfaces for up to 72 hours.⁵

The mild expression of infection amongst children, aerosol transmission, incubation period without symptoms prompt the dentists to take obligatory precautions to curtail the risk of transmission in the dental office.⁴

Teledentistry

Across many countries, several primary and secondary dental services have been banned, with many countries providing telephone based triage systems to diagnose those patients requiring immediate or emergency intervention.⁵ Triage by telemedicine (telephones, video calls, video monitoring) and management of patients suspected of COVID-19 without a face to face visit is highly recommended.¹¹ The dentist talks over the phone with the parents to obtain all the possible information both on child health status and the oral symptoms in order to understand if the dental procedure represents an urgent need and cannot be postponed.³

Currently, several smartphone applications, such as DOCTOR Oral® diagnosis, are available for medi-

cal practitioners, clinicians and dentists, in order to perform tentative quick diagnosis just by viewing a picture taken on the patient's smartphone.¹² In the USA, the US Telephone Health (Telehealth) systems have been introduced which is free and transparent to patients during the COVID-19 public health emergency. In Brazil, Telehealth services have been regulated by the Ministry of Health to scale down the disease transmission.⁵

Infection Control

Interestingly, the nosocomial transmission by airborne SARS-CoV-2 virus-laden aerosols in healthcare facilities may be plausible.⁶ Effective infection control is mandatory to prevent or minimize the risk of infection transmission via organized dental procedures which cannot be delayed or postponed. Dental triage of usual dental conditions categorizes patients into 3 types. 1-mild/moderate symptoms and can be managed remotely by antimicrobials and requires advise and self-help, 2-urgent care needed. These patients have severe or uncontrolled symptoms unmanageable by patient and requires to see a dentist, 3- emergency care for emergency condition which require immediate attention.¹¹ The dental treatments can be done by means of the following methods:

- 1. Limiting the points of entry-** monitor and limit the points of entry to the dental facility¹¹.
- 2. Waiting room-** animated videos showing the technique of hand hygiene.¹
- 3. Social distancing** -Patient appointments should be properly arranged so that no more than one child patient with one accompanying guardian are present in the dental office.^{11,13} In the event of overlapping patient appointments, in the reception area, ensure that all individuals maintain a safe distance from each other.⁴ Though social distancing would be promising in combatting the COVID-19, the minimum distances that have been maintained between an infected person and a host are arguable and are a long way from being established based on any scientific proof.⁶
- 4. Body temperature estimation** - the paediatric dentist, auxiliaries, patient and accompanying per-

son should be investigated for their body temperature using a contact free forehead infra-red thermometer.³

- 5. SpO₂-** fingertip pulse oximeter before entering the dental office.⁴

6. Protective equipment for the patient and accompanying person - hand hygiene by handwashing or by means of 60-95% alcohol rub^{1,11} or sanitizing gels immediately before entering the dental office and use of disposable coveralls / barriers should be provided to minimize the contact of possibly virus contaminated clothes with different surfaces of the office.^{3,4} Children are encouraged to pretend that they are putting on special power suits. And moreover, making children dress similar to the dental clinic staff could decrease the fear of children seeing everyone in coveralls and gowns.⁴ For children able to spit, the use of a pre-procedural antimicrobial mouth rinse (PPMR) like 1% hydrogen peroxide or 0.2% povidone iodine are recommended owing to the fact that it has nonspecific virucidal activity against corona viruses. However, Chlorhexidine may not be potent in destroying SARS-CoV-2.^{1,3,4}

7. Controlling gag/ cough reflexes - Avoid posterior intra oral and bitewing radiograph. Rather, OPG/ CBCT maybe advised.^{1,7} Impressions maybe avoided or sedation maybe performed to avoid gag reflex.⁷

8. Control of cross infections - Children's toys, magazines, seats, faucets, restraining devices such as Velcro fasteners etc. maybe sources of cross infection as they are difficult to be disinfected. The use of these maybe avoided.^{7,11} The clinical setting should be disinfected after dismissal of every patient using standard hospital grade disinfecting solutions (US Environment Protection Agency).^{4,11} After working on a patient without suspected or confirmed COVID, wait for 15 mins after the dental treatment is completed and the patient has exited to begin the disinfection process of the dental operatory and surroundings. This allows the droplets to fall from air after the procedure and ensure sufficient surface disinfection.¹¹ The frequently touched surfaces like handles, chairs, screens, keyboards, phones, lamps etc. should be disinfected and is critically important as the virus could survive on these surfaces for several

hours to days depending on the temperature and humidity.³ The reception area including door handles, seats etc. should be thoroughly disinfected to prepare the area for the next patient.⁴

9. Reducing splatter / bioaerosol generation-

Extra oral evacuation devices and specialized devices for aerosol reduction which removes infectious droplets at the source as they are emitted; thereby minimizing or preventing their dispersion in air maybe promoted.⁷ Anti-retraction dental hand-pieces with specially designed anti-retractive valves help curtail cross contamination.⁴ Use of minimally invasive dentistry should be prioritized, such as pit and fissure sealants, SDF, selective caries removal, Halls technique, CMCR and ART including SMART¹ (Silver modified atraumatic restorative technique) technique should be taken into consideration and promoted.^{3,5,7,11} Also, use of four handed technique along with use of clean and sterile hand instruments is recommended to contrast viral spread.³

10. Management of contaminated air - the exhaust air must be vented outside to prevent the recirculation of the contaminated air.⁷ Ventilation system that maintains the negative pressure in the operating room is recommended. Considering air disinfection using ozone gas or ultraviolet germicidal irradiation is ideal. Use of a portable HEPA (High Efficiency Particulate Air) air filtration unit maybe also considered during and following aerosol generating procedure.¹¹ In the absence of these systems, it is advised to keep the windows of the office open to let the air circulate.⁴

11. Improving personal protection - Hand hygiene to remove any possible pathogen transfer to bare hands, using disposable barriers, dispensing clean and sterile dental instruments and materials just before treatment, personal protective equipment including gowns, hair covers, clean non sterile gloves, respirators, shielded face masks, shoe covers should be used as appropriate (CDC and prevention 2020).⁴ Hand hygiene may be performed with 60-95% alcohol or washing hands with soap and water for at least 20s.¹¹ Hand hygiene recommended by WHO is “two before, three after” - i.e., washing hands.

- a. Before touching a patient
- b. Before clean/ aseptic procedures
- c. After body fluid exposure/ risk
- d. After touching a patient
- e. After touching patient surroundings¹

Eye protection - Remove eye protection prior to leaving the operatory. Reusable eyewear must be thoroughly cleaned and disinfected. Personal eye glasses and contact lenses are inadequate.¹¹

Mask- Instead of the use of the regular surgical masks, the use of particulate respirators like the surgical N95 respirators authenticated by the NIOSH or the FFP2-standard masks set by the European Union are advised as it offers a certain level of protection against the airborne transmission of SARS-CoV-2.^{1,7} Alternatives to N95 masks include filtering face piece respirators N99, N100, P95, P99, P100, R95, R99, R100, full facepiece air purifying respirators and elastomeric half masks.¹¹

PPE suits and face shields can also be modified with cartoon designs to modify the child’s behavior.¹ Use of a clean isolation gown is done and removed to be discarded in a waste or linen container before leaving.¹¹

Before entering a patient care area, perform hand hygiene and don a clean protective clothing or gown that covers skin and personal clothing likely to be soiled by potentially infectious material like blood, saliva, or other materials. If a protective clothing become soiled, they should be changed. A respirator is worn and the mask ties are secured on the crown of the head (top tie) and base of the neck (bottom tie). If loops are present, hook the mask around ears. Respirator straps should be placed on the crown of the head and base of the neck and checked for a user seal check each time. Eye protection should not include personal eyeglasses and contact lenses. Perform hand hygiene and non-sterile gloves are worn. They should be changed when torn or heavily contaminated prior to entering the room. After completion of dental care, gloves are removed and the gown or protective clothes are discarded in container for waste or linen. Disposable gowns are discarded after each use and protective clothes are laundered after each use. Exit the patient care area and

perform hand hygiene, remove eye protection by grabbing the strap and pulling upwards and away from head without touching the front of the eye protection. Clean and disinfect reusable eye protection prior to reuse by the manufacturer's reprocessing instructions but discard disposable eye protection after use. Remove and discard surgical mask or respirator without touching the front. For a surgical mask untie (or unhook from the ears) and pull it away from the face carefully without touching the front. For a respirator remove the bottom strap by touching the strap only and bring it over the head carefully. For the top strap; grasp it and bring it over the head to pull the respirator away from the face without touching the front. Finally perform hand hygiene to follow standard precautions.^{11,13}

Limit DHCP during a procedure to those essential for the procedural support and patient care. This avoids multiple room entry and bundling. Entry of a known or suspected COVID-19 patient must be restricted or allowed to enter with PPE. DHCP at higher risk for severe illness from COVID-19 (old age, pregnancy, comorbidities) should be excluded from caring for a confirmed or suspected COVID-19 infection. DHCP recovered from COVID-19 can care for COVID-19 infected patients.¹¹

12. Rubber dam isolation - Could significantly limit airborne particles in a 3-foot diameter of operational field by 70%.⁴

13. Infectious waste management - Extracted teeth are potentially infectious and thus disposed in medical waste bins. Extracted teeth sent to a dental laboratory for shade or size comparisons should be cleaned, surface-disinfected with a hospital grade disinfectant. Dental prostheses, appliances, impressions and bite registrations need to be managed by coordination between the laboratory and dental practice with appropriate cleaning and disinfection with a hospital grade disinfectant.¹¹

14. Monitoring DHCP- DHCP should monitor themselves regularly for fever and symptoms of COVID-19.¹¹

CONCLUSION

There isn't enough scientific literature available on the model to be followed in the management of pae-

diatric dental patients during the outbreak of such a pandemic. The role of the dental fraternity is critically important since it has the highest risk of spreading the virus in relation to COVID-19. This pandemic would change the outlook of the routine dental practice all over the world and the focus might change to preventive dentistry rather than invasive procedures which would put the DHCP unwittingly at risk. Since this pandemic continues to evolve and change day by day, paediatric dentists and other health care professionals should keep up with a high level of awareness of evidence-based guidance to help and treat patients, preventing risk and nullifying viral spread. Strict universal precautions for control of cross infection to safeguard the health of the DHCP and patients is mandatory. This should be continued ideally throughout the pandemic, and in future as and when practice restrictions ease.

REFERENCES

1. Koticha PB, Pradhan D, Katge F, Krishna V, Bhanushali P, Patil D. COVID-19 in Children: Its Impact on Oral Health and Paediatric Dentistry. 2020;(3):13.
2. Boopathi S, Poma AB, Kolandaivel P. Novel 2019 coronavirus structure, mechanism of action, antiviral drug promises and rule out against its treatment. *Journal of Biomolecular Structure and Dynamics* 2020;0(0):1–10.
3. Ferrazzano GF, Ingenito A, Cantile T. COVID-19 Disease in Children: What Dentists Should Know and Do to Prevent Viral Spread. The Italian Point of View. *International Journal of Environmental Research and Public Health* 2020;17(10):3642.
4. Bahramian H, Gharib B, Baghalian A. COVID-19 Considerations in Pediatric Dentistry. *JDR Clin Trans Res* 2020;5(4):307–11.
5. Mallineni SK, Innes NP, Raggio DP, Araujo MP, Robertson MD, Jayaraman J. Coronavirus disease (COVID-19): Characteristics in children and considerations for dentists providing their care. *Int J Paediatr Dent [Internet]* 2020 [cited 2021 May 15]; Available from:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7228382/>

6. Jayaweera M, Perera H, Gunawardana B, Manatunge J. Transmission of COVID-19 virus by droplets and aerosols: A critical review on the unresolved dichotomy. *Environ Res* 2020;188:109819.
7. Al-Nerabiah Z, Alkhouli M, Laflouf M. Pediatric dentists consideration for Covid-19 in children: Review article. *International Journal of Applied Dental Sciences* :3.
8. Oral manifestations in a patient with a history of asymptomatic COVID-19: Case report | Elsevier Enhanced Reader [Internet]. [cited 2021 May 9]; Available from: <https://reader.elsevier.com/reader/sd/pii/S1201971220307001?token=4D2F05DE400246236F51CE5AF2AB4D62EFE491DE0F06321FEE203290510EB59367CF651C7861A26F2DFBAF0C625DB36&originRegion=eu-west-1&originCreation=20210509085807>
9. Xu Y, Li X, Zhu B, Liang H, Fang C, Gong Y, et al. Characteristics of pediatric SARS-CoV-2 infection and potential evidence for persistent fecal viral shedding. *Nat Med* 2020;1–4.
10. Clinical manifestations of children with COVID-19: A systematic review [Internet]. [cited 2021 May 9]; Available from: <https://onlinelibrary.wiley.com/doi/epdf/10.1002/ppul.24885>
11. Shah S. COVID-19 and paediatric dentistry-traversing the challenges. A narrative review. *Ann Med Surg (Lond)* 2020;58:22–33.
12. Cervino G, Oteri G. COVID-19 Pandemic and Telephone Triage before Attending Medical Office: Problem or Opportunity? *Medicina (Kaunas)* [Internet] 2020 [cited 2021 May 16];56(5). Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7279364/>
13. CDC. Healthcare Workers [Internet]. Centers for Disease Control and Prevention 2020 [cited 2021 May 15]; Available from: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/dental-settings.html>