



## IMPEDIMENTS TO CONSERVING CHILDREN'S ORAL HEALTH POST COVID-19 PANDEMIC

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### ABSTRACT

The health of a society is partly dependent on maintaining the oral health and hygiene of children. The ever-evolving and inspiring field of pediatric dentistry has a new challenge in the face of the COVID-19 pandemic. Constraints on children's movements outside the home environment restricted access to their regular dental services. The ability to achieve and preserve good oral health under the given circumstances became a daunting task, if not an impossible one. This article brings out the challenges faced by parents/caregivers and pediatric dentists in supporting children to continue to maintain good oral health and minimize the chances of any acute episodes requiring emergency dental visits during such pandemic times. It also highlights the changes brought about in children's education mode and physical activity due to the pandemic lockdown along with suggestions to parents/caregivers regarding the importance of physical activity, maintenance of optimal oral health, and the advantages of limiting in-between meals snacking.

**KEYWORDS:** Children's oral health, COVID-19 pandemic, physical activity in children, screen time.

### INTRODUCTION

Towards the end of 2019, the world woke up to the worst pandemic of this century yet, when the arrival of the COVID-19 virus was announced. This soon brought our lives to a practical standstill in a short time. Medical services were one of the worst-hit and extending routine or emergency dental treatments to patients became indeterminate. Pediatric dental surgeons and parents of children with dental problems had to ponder over ways to keep dental emergencies at bay. This article describes the predicaments of pediatric dentists in delivering dental care to children during and after such pandemics, emphasizing the aspects of a) maintaining the veracity of children's oral health through such pandemics in the context of evolving technological advancements and b) challenges to providing dental services to pediatric patients after such pandemic lockdowns.

### COVID-19 PANDEMIC

With the World Health Organisation (WHO) declaring the COVID-19 pandemic, a complete lockdown was imposed in all nations across the world. Educational institutions were closed and examinations were either

cancelled or postponed; all other services were shut down save a few. Hospitals undertook only emergency services. Authorities, educational institutions, and teaching professionals gradually started adapting to what became the new normal and began to impart education through online mode using the several audio-visual communication platforms available. This provided a chance for the students to start their school curriculum at least in part. But at the same time, children ended up with extended exposure to desktop computers, laptops, mobile phones, tablets resulting in increased screen-time. Unfortunately, this was further coupled with the fact that they were confined to the premises of their own homes with strict restrictions on venturing out. Restrictions and limitations in physical activity due to confinement to the home environment has several effects on the physical as well as mental aspects of children. Irregular eating habits and excessive snacking between meals coupled with erratic oral hygiene has potentially deleterious effects on the children's oral health and oral hygiene.

In India, according to the '2018 Report Card,' less than half of the children adhere to the recommended screen

time less than 2 hours per day, while only 15% of youth and children follow the recommended minimum fitness standard; about 30% of peers/family take part in physical activity with children or provide access to physical activities.<sup>[1]</sup> While these figures and statistics refer to the pre-COVID scenario, the conditions after the pandemic lockdown have restricted most of the children's daily routine activities; with schools shut, children are stuck to their screens for the best part of the day. This poses a quandary to the overall well-being of children with great bearings on dental health due to various factors highlighted further.

### CHANGES IN CHILDREN'S EDUCATION AND LIFESTYLE CONSEQUENT TO THE COVID-19 PANDEMIC

Electronic Screen Syndrome (ESS): Accessibility to electronic media has increased exponentially for the current generation than ever before with the previous decade witnessing an explosion of exposure among children below the age of 3 years.<sup>[2, 3]</sup> Such exposure early during childhood could lead to anatomical and neurochemical alterations in the brain. Children with increased screen time were found to have significantly lower levels of melatonin.<sup>[4]</sup> Increased screen-time has also been shown to be associated with an increase in melanopsin-expressing neurons and decrease in gamma-aminobutyric acid (GABA) – a neurotransmitter, which might result in harmful effects like abnormal behavior, diminished cognitive ability, impaired mood, and language development skills, hyperactivity, autistic spectrum behavior, curtailed attention span along with irritability. Deficiency of neurotransmitters like acetylcholine, 5-hydroxytryptamine (5-HT), and GABA has been observed in urban children addicted to the internet, which might lead to a variety of unusual behavior phenotypes.<sup>[5]</sup> Children with less than 3 hours of screen time per day had a short attention span and delayed language skills as compared to children with more than 3 hours of screen time per day who demonstrated hyperactivity along with delayed language skills and short attention span.<sup>[6]</sup>

Fischer introduced a novel term called 'Electronic Screen Syndrome'(ESS) encompassing an array of unrecognized ailments related to mental health and electronic media.

Some of these symptoms include alterations in behavior, mood, cognition, social interaction, and anxiety, all due to hyperarousal.<sup>[7]</sup> Aberrant light emitted from screens of various electronic media brings about mood alterations via intrinsically photosensitive retinal ganglion cells (ipRGC) projections into regions of the brain which are involved in emotions. These may also suppress nocturnal melatonin leading to sleep disturbances.<sup>[2, 4]</sup>

Physical inactivity in children: According to Dimitri, though one out of six deaths in the United Kingdom (UK) was due to physical inactivity, which cost the economy a whopping £7.4billion annually, the current general population demonstrates approximately 20% lesser physical activity than they did fifty years ago.<sup>[8]</sup> In India, the prevalence of inactivity is 21% in children aged 3 to 11 years.<sup>[9]</sup> Sedentary time in children increases the chances of risk to poor mental health and such inactive time of more than 2 to 3 hours per day has been proven to significantly elevate the risk of developing symptoms of depression along with higher anxiety levels.<sup>[10]</sup>

Diet and dental health of children: Children are susceptible to various oral diseases with habits and oral hygiene status affecting their Oral Health-Related Quality of Life (OHRQoL).<sup>[11]</sup> Irregular dental check-ups have a significant correlation with a greater incidence of untreated carious lesions.<sup>[12]</sup> Children who did not visit their dentist for over a year were reported to have lower OHRQoL scores.<sup>[13]</sup> In India the overall prevalence of dental caries among children is more than 50% with an average DMF score of 2 to 3.<sup>[14-17]</sup> This prevalence of caries is greater in the southern and western parts of India.<sup>[17]</sup> Access to and availability of nutritious food is a positively correlating factor that is associated with healthy food behaviors at home.<sup>[18]</sup> Studies have demonstrated that children with obese characteristics tend to demonstrate increased chances of inter-proximal caries<sup>[19]</sup> and also increased chances of smooth surface caries than their normal-weight counterparts.<sup>[20]</sup> The one factor with a suggestively positive correlation to dental caries, especially in children, has been in-between meals snacking. Table 1 shows the studies conducted by various authors and their findings regarding this correlation.

**Table 1: Correlation of snacking in-between-meals and caries prevalence among children.**

Sl. No.	Author and Year	Age group	Snacking habits (%)	Caries prevalence (%)
1.	Jose B and King NM, 2003 <sup>[21]</sup>	8 to 48 months	83%	44%
2.	Joshi N, et al., 2005 <sup>[22]</sup>	6 to 12 years	67%	77%
3.	Retnakumari N, and Cyriac G, 2012 <sup>[23]</sup>	12 to 36 months	98.3%	50.6%
4.	Prakash P, et al., 2012 <sup>[24]</sup>	8 to 48 months	76.8%	29.2%
5.	Kuriakose S, et al., 2015 <sup>[25]</sup>	Up to 60 months	61.7%	54%
6.	Jain M, et al., 2015 <sup>[26]</sup>	0 to 71 months	More than 3 times a day in 43% children	deft 5.32
7.	Punitha VC, et al., 2015 <sup>[27]</sup>	13 to 19 years	More than or equal to 4 times a day	19.67 times increased chances of caries in children who ate confectionery more

				than 4 times a day
8.	Gopal S, et al., 2016 <sup>[28]</sup>	3 to 6 years	76.9%	27.3% dmft 2.36
9.	Koya S, et al., 2016 <sup>[29]</sup>	24 to 71 months	99.8%	41.9% DMFT 5.28±2.39

From these studies, it is evident that children who indulge in snacks in between meals are more prone to dental caries than their counterparts who do not have such snacking habits. The oral environment, especially in young children, is influenced and modified by various factors like frequency of food intake, immature host defences, and oral hygiene practices.<sup>[28]</sup> Children with dental caries had an increased frequency of ingesting carbonated drinks and confectioneries and the DMFT scores in such children were significantly higher as compared to children who had foods like vegetables and fruits.<sup>[27]</sup> Additionally, an increase in the consumption of energy and health drinks along with health supplements, especially vitamin C during the COVID-19 pandemic which has been recommended by the various health authorities, could lead to their increased erosive potential on the dental hard tissues. Children who regularly consumed vitamin C supplements had shown significantly higher rates of dental erosion.<sup>[30]</sup>

Though a study showed that children with adequate intake of vitamin C had shown to have lesser tooth surfaces involved in caries,<sup>[31]</sup> vitamin C tablets used in high frequency as supplements, especially when left in contact with teeth for a long time have been shown to cause increased chances of dental erosion.<sup>[32,33]</sup> An estimated 4.7 times increased risk of erosion was seen in children when they were given vitamin C supplements.<sup>[30,34]</sup>

#### Approaches to maintain optimal oral health in children during the pandemic

Two vital mediators between oral health outcomes and literacy are dental neglect and self-efficacy.<sup>[35]</sup> The framework to address oral health disparities was studied and it was observed that low literacy in caregivers regarding the oral health of children was associated with poor oral health patterns such as irregular tooth brushing habits and night-time bottle use leading to deleterious oral health status.<sup>[35-37]</sup> Promoting good oral hygiene habits resulted in clearance of cariogenic substrate from the oral cavity.<sup>[38]</sup> The desirable behavior patterns for optimal oral health are brushing twice a day with a fluoridated dentifrice, regulating frequency and quantity of fermentable carbohydrate intake in the diet, and, prevention-oriented dental health check-ups early during childhood. Such oral health messages should be tailored to the specific target population based on their level of cognition.<sup>[39]</sup>

Dietary counseling and nutritional education have shown to reduce caries incidence in children. Parents should be educated regarding the importance of choosing between cariogenic and non-cariogenic snacks for their children

and bring about dietary changes based on realistic goals so that such changes will help to develop life-long good dietary habits in children themselves.<sup>[38]</sup> Accordingly, nutritional counseling in children should emphasize the concepts of reducing exposure to dietary sugars, avoiding consumption of sugar-containing juices and drinks frequently, discontinuing the habit of making children fall asleep with a bottle, restricting snacks that contain high sugar content, limiting cariogenic food items to meal-times and promoting non-cariogenic food items for snacks time.<sup>[38]</sup> Children of mothers who received such dietary counseling showed a 42% to 65% reduced caries experience at 4-years of age as against age-matched control children.<sup>[40, 41]</sup> Furthermore, there was a decrease in increments of caries by about 85% following reinforcement and counseling in children who had active carious lesions.<sup>[42]</sup>

Sports and physical activity have a constructive effect on the physical as well as mental health of children and adolescents.<sup>[10, 43-45]</sup> Engaging in any physical activity for more than an hour every day significantly enhances the mental health of children.<sup>[10]</sup> Regular and long-term physical activity is beneficial among children with deficient general health also.<sup>[8]</sup> Such activity also helps in maintaining optimal oral health in children via several immunologic and non-immunologic mechanisms.<sup>[46-50]</sup>

Adding physical activities to the children's routine has the advantages of reduced body mass index (BMI) and improved body composition, bone mineral density, enhanced cardio-respiratory fitness in children with Type 1 Diabetes Mellitus,<sup>[51, 52]</sup> lessened epileptiform episodes, and reduced frequency of seizures with short, non-strenuous activities in individuals with a history of epilepsy,<sup>[53-55]</sup> reduced symptoms, improvement in cardiovascular fitness and functioning along with the improved quality of life in children with asthma.<sup>[8]</sup> Studies have proven that individuals engaged in some form of frequent and intense physical exercise or sporting events are more resilient to traits of depression in later stages of life and tend to demonstrate higher degrees of self-esteem.<sup>[44, 45]</sup> A physical activity of at least 60 minutes per day helps in improving mental health in children.<sup>[10]</sup>

Physical activity also influences and enhances salivary secretion exerted via sympathetic influence.<sup>[48,49]</sup> Adequate quantity and quality of salivary flow is important for optimal oral hygiene and interestingly, physical exercise displays significant beneficial changes in the oral environment. The unstimulated saliva maintains the veracity of the oral tissues whereas the stimulated saliva aids in the digestion of food.<sup>[46]</sup>

Ligtenberg *et al.*, found that moderate to high-intensity exercise increased salivary secretion rates significantly.<sup>[49]</sup>

Saliva forms a lubricating proteinaceous film on enamel which inhibits enamel erosion by stalling acid attack.<sup>[56]</sup> Several immunologic and non-immunologic factors assist in bacterial clearance by selectively binding to some of the bacterial entities of the oral cavity.<sup>[57]</sup> pH and salivary flow rate are the physicochemical properties that play an important role in the development of carious lesions. An increased salivary flow rate leads to enhanced clearance and related reduction in microbial attack.<sup>[58]</sup> Caries risk increases exponentially with a low salivary flow rate whereas an increase in salivary flow rate assists caries prevention<sup>[46,56]</sup> Additionally, the key defensive properties of saliva concerning tooth minerals (salivary buffering capacity, degree of saturation) are greatly enhanced with an increase in salivary stimulation.<sup>[59]</sup> Therefore, stimulating the salivary flow rate is beneficial for oral health.<sup>[46,50,56]</sup>

Given these benefits of physical activity, caregivers must be instructed to encourage their children to be engaged in some form of exercise, as even short-bouts of physical activity at regular intervals in a day have beneficial effects on general and dental health.

Yoga (breathing as well as physical exercise techniques) is another such method that can be easily incorporated into daily life and practiced at home without the necessity of additional equipment. It is an effective, gentle, and non-threatening technique to enhance not only physical fitness but also health and overall well-being.<sup>[60]</sup> Several studies have shown the positive effects of yoga in children too.<sup>[61-63]</sup> A study conducted in fifth-grade children demonstrated that children who practiced yoga for 60 minutes every day showed 47.6% improvement in their ability to control anger and rage in a stressful situation, there was increased emotional balance along with a reduction in anxiety levels, feeling of defeat, impulsiveness, and shyness in social situations.<sup>[61]</sup> Yoga also improves fitness, attention problems, perception, and cognitive performance helps in combating chronic illness, anxiety, stress, and eating disorders, and problems of obesity.<sup>[62,63]</sup>

With the advent of worldwide connectivity and availability of online emergency consultations during the current pandemic situation, teledentistry serves to promote dental health education in caregivers and children. Tele-dentistry is an invaluable tool in the current scenario and aids pediatric dentistry in evaluating the symptoms, travel history, and prescribing appropriate medication to the patients.<sup>[64]</sup> Visits to the dental office can be postponed while keeping in contact with the patient regarding his/her dental pathology via text messages. In case of a dental emergency, the patient can be referred to the closest emergency care facility where treatments are provided with all the necessary

precautions. Such emergencies could include dento-alveolar trauma leading to pulpal exposure or avulsion of a permanent tooth, uncontrolled bleeding or severe, acute pain of dental origin, dysphagia, or airway obstruction due to a worsening swelling of the oro-facial region, and conditions dental origin that may aggravate and existing systemic condition. Teledentistry services minimize the risk of infection to everyone involved due to the policy of hospital triaging and help to keep in contact with patients for any further required follow-ups.<sup>[65]</sup> Utilisation of teledentistry services in child dental care is a viable option and pediatric dentists need to educate themselves and their entire team to be well-versed with the technological developments.<sup>[64]</sup>

### The post-pandemic challenges to pediatric dentists in patient management

- Behavioral management challenges due to possible behavioral changes in children consequent to
  - Excessive exposure to electronic multimedia.
  - Limited or no physical activities.
  - Presenting to the dental operatory due to emergencies.
- Untreated carious lesion
  - Incipient carious lesion progressing into deeper lesions and deeper carious lesion progressing close to pulp and leading to reversible or irreversible pulpal conditions.
- Undiagnosed/undetected habits and the resultant malocclusion.

### Recommendations to parents/caregivers based on scientific evidence

The parents/caregivers should be educated to:

- Encourage children to participate in exercises, physical activities, and yoga.
- Limit in-between meals snacking, sugary confectionaries, syrups, and excessive vitamin supplements.
- Emphasize the importance of maintaining oral hygiene through various methods (brushing-flossing-rinsing habits).
- Keep a check on deleterious habits and report any such activity by children to the dentist.
- Utilize the teledentistry services to consult their dentist in case of any emergency dental conditions.

### CONCLUSION

One of the crucial responsibilities of a healthy society is to improve the oral health status of children. Due to the current pandemic, several competent authorities like the WHO, Center for Disease Control and Prevention (CDC), American Dental Association (ADA), and Indian Dental Association (IDA) have been providing interim guidelines based on the progression of the pandemic. As a result, all routine dental check-ups and regular follow-ups have suffered a setback. Pediatric dentists should aim to team up with caregivers to aid and guide them in

achieving and maintaining good oral health status in children while facing the eventualities of such pandemic and lockdown situations.

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