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COVID-19 in Pediatric Patients: A Literature Review

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ABSTRACT

This article aims to review the features of COVID-19 in children and whatever dentists need to perform to protect themselves, their young patients, and staff. A new form of coronavirus infection occurred in Wuhan, China, in mid-December 2019, and it has quickly spread to almost the whole world. Although COVID-19 was primarily more common among adults over 15 years old at the initial steps of the outbreak, and the percentage of children's confirmed cases was fairly low, the new guidelines show that all people, including children, are typically vulnerable to SARS-CoV-2. Also, we should take patients' behaviors and reactions to COVID-19 into consideration during this pandemic situation. Since preventing the transmission of SARS CoV-2 to children and transmission from infected children or parents to healthcare professionals are important, infection prevention checklists and all the points that this study prepared should be used by the whole dentists.

1. Introduction

A new form of coronavirus infection occurred in Wuhan, China, in mid-December 2019, and it has quickly spread to almost the whole world. By now, this disease outbreak has suddenly spread to all China provinces and 212 countries, areas, or territories with cases. Genome sequencing of the virus separated from a lower respiratory tract of patients verified that the virus is the latest coronavirus. The World Health Organization (WHO) pointed out this pathogen "2019 novel CoronaVirus (2019-nCoV)". On February 11, 2020, the WHO described the latest coronavirus as CORonaVirus Disease-2019 (COVID-19). On March 12, 2020, the WHO declared that COVID-19 attained a pandemic situation.^[1-3]

Recent studies revealed that Severe Acute Respiratory Syndrome CoronaVirus 2 (SARS-CoV-2) is a new member of the coronavirus family, called the β -genus. The genetic features are markedly distinct from features of SARS-CoV and Middle East Respiratory Syndrome CoronaVirus (MERS-CoV). SARS-CoV-2 is over 85%, similar to bat SARS-like CoV (bat-SL-CoVZC45). The Wuhan Institute of Virology gathered proof that SARS-CoV-2 derived from bats and reported that SARS-CoV-2, like SARS-CoV, reaches cells by attaching to the Angiotensin-Converting Enzyme 2 (ACE-2) receptor.^[1,4]

2. Clinical presentations

COVID-19 has been primarily more common among adults over 15 years old at the pandemic's initial steps. The percentage of children's confirmed cases was fairly low. Ever since, however, more areas have conducted pathogen identification programs and, as younger children are not able to put on facial masks and take other specific protective and control measures, the number of confirmed cases among children especially in younger groups has significantly increased. These age groups need to have higher attention.^[5] The percentage of COVID-19 confirmed cases among children aged <18 is shown in Table 1.^[6]

Table 1. Percentage of COVID-19 confirmed cases among children younger than 18 years old.

Country	% of COVID-19 confirmed cases among children younger than 18 years old
United States	2%
China	2.2%*
Italy	1.2%
Spain	0.8%

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China announced the percentage of COVID-19 confirmed cases among children younger than 19 years old).^[5] The age distribution of confirmed cases among children aged <18 in the United States is identified in Table 2.^[7]

Table 2. Age distribution of cases among children aged <18 in the United States.

Age	% of cases among children younger than 18 years old in the US
<1	15
1-4	11
5-9	15
10-14	27
15-17	32

The new guidelines also show that all people, including children, are typically vulnerable to SARS-CoV-2. Children display particular symptoms and may not identify their health condition or contact background, led to the serious difficulty of preserving, diagnosing, and curing this age group.^[8] The experiences gained so far are not complete, but they deserve dissemination and public attention to better train dentists for the next challenges.^[9] This paper studies the features of COVID-19 in children and whatever dentists need to perform to protect themselves, their young patients, and staff.

Symptoms

The signs of infection with COVID-19 emerge after an incubation time of roughly five days.^[1, 10] The initial COVID-19 clinical signs and symptoms were 6 to 41 days, with a median of 14 days.^[11] This length depends on the patient's age and background of the patient's immune system. The most typical signs at the advent of COVID-19 disease are fever (≥ 37.3 °C or 99.14 °F), cough, accompanied by shortness of breath, and fatigue or myalgia. In contrast, other clinical symptoms are sputum production, hemoptysis, diarrhea, headache, vomiting, dyspnea, and lymphopenia.^[1, 11, 12]

Children are more likely to experience vomiting and diarrhea, while fatigue or myalgia was reported more frequently in adults. The median period of fever ranges from 0-3 days for children and four days with a range of 1-10 days for adults. There were no significant differences in the upper limit of body temperature between the two groups (38.24 ± 1.10 °C vs. 38.18 ± 0.62).^[13]

Investigation of more than 2000 confirmed or suspected COVID-19 child patients in Hubei, China, resulted in that above 90% were asymptomatic or with mild to moderate signs.^[14] There is insufficient evidence on laboratory findings linked to COVID-19 in children. No significant leukocyte abnormalities have been identified in pediatric patients than adult patients with COVID-19.^[15-17]

Transmission

SARS-CoV-2 could be transmitted through direct or indirect contact, primarily through respiratory droplets and splashes from saliva and blood.^[1, 18-20] Therefore, dentists are at high risk of transmission. Most dental procedures are Aerosol Generating Procedures (AGPs) that correlate with acute respiratory contaminations transmission. Moreover, dental offices are more likely to have many possibly infected areas such as dental chairs, the spittoon, handles, and dental instruments after performing the procedures that are potential transmission ways.^[14] SARS-CoV-2 may sustain on surfaces for up to 9 days, and all areas must be sanitized using chemicals according to the guidelines. Surface sanitizers contain 62%–71% ethanol, 0.5% hydrogen

peroxide, and 0.1% (1 g/L) sodium hypochlorite. All surfaces must be thoroughly wiped down after each patient's visit, especially around the operating areas.^[1]

Due to the long period of incubation (2-14 days) and the fact that children may be asymptomatic or present with mild or nonspecific symptoms, both children patients and parents must be regarded as potential COVID-19 carriers. The quarantining duration for suspected pediatric patients must be over 14 days.^[21] In all dental clinics, universal precautions should be regularly taken. They are important in preventing the SARS CoV-2 transmission to kids and transmission from infected children or parents to dental workers. Infection prevention checklists should be utilized, which include dental healthcare personnel safety, administrative measures, infection prevention education and training, program assessment, hand sanitization, disinfecting patient-care items and tools, Personal Protective Equipment (PPE), safe injection methods, and water quality of dental clinic.^[1, 22-23]

Treatment Options and Vaccines

To date, there has been no evidence from randomized controlled trials to recommend any specific anti-nCoV procedure, and the management of COVID-19 has been broadly supportive.^[1]

Gautretab et al. analyzed 20 patients and observed a substantial decrease by obtaining 600 mg of hydroxychloroquine per day in the viral transmission and the mean length of carrying compared to untreated patients. Besides, adding azithromycin to hydroxychloroquine was highly more effective in the elimination of viruses.^[24]

Convalescent Plasma (CP) was used as a primary procedure against COVID-19. The CP is obtained from an individual recovered from COVID-19 by developing humoral immunity against the SARS-CoV-2. CP's preventive and therapeutic benefit is due to the possible source of unique antibodies of human origin. However, it is still difficult to assess CP therapy's efficiency because of the lack of high-quality randomized clinical trial studies and a certain plasma therapy process.^[1, 25]

Now, the strategy regarding COVID-19 is to monitor the source of infection by avoiding the contamination and managing measures to reduce the spread risk and offer early identification, quarantining, and help infected patients. Several clinical trials are being performed to examine more effective procedures.^[1] Most of the articles about the treatment in COVID-19 infected children pointed out supportive therapy, including antibiotics for bacterial superinfections and oxygen therapy. A few researchers suggested antiviral treatment. The antiviral treatment has been specifically used in severe cases, but there are no details about its efficacy on children with COVID-19.^[26] Vaccination is the most efficient and cost-effective tool to track and stop COVID-19 under the pandemic circumstance. Extensive studies are currently underway to enable the development of SARS-Cov-2 vaccines. Specifically, the SARS-Cov-2 spike protein remains the primary target for vaccine production.^[27]

COVID-19 is Very Mild in Children

The explanations of the mild complications in most children with COVID-19 are currently not apparent, although there are some possible mechanisms within the areas of immunology, anatomy, and virology.^[28] The immune systems of adults and kids are generally distinct in terms of composition and functional sensitivity. One potential reason for the milder COVID-19 appearance in kids is that children respond qualitatively different to the SARS-CoV-2 compared to adults. Another reason may be that other simultaneous viruses in the mucosa of lungs and airways that are frequent in younger kids may inhibit the growth of SARS-CoV-2. This is consistent with

the ongoing data from the current outbreak, which has presented a correlation between the number of viral copies and the intensity of COVID-19. It may also justify some of the tragic deaths of front-line healthcare professionals exposed to significant quantities of the SARS-CoV-2.^[28]

Another plausible explanation for the moderate infections of COVID-19 in children is that there are differences in the expression of ACE-2 essential for SARS-CoV-2 binding and contamination. ACE-2 can be found in the airways, lungs, and intestines, but not in the immune cells. The procedure with ACE inhibitors or angiotensin receptor blockers causes ACE-2 expression. Both treatments are frequent in adults with hypertension and much less frequent in kids. This fact caused some researchers to conclude that the increased ACE-2 expression might explain the worse effects in adults contaminated with SARS-CoV-2, but others identified protective effects of ACE2 during lung infections.^[28]

Cristiani et al. also found that high concentrations of ACE-2 receptor, trained immunity, and high lymphocyte count in kids may partly justify the mildness of the disorder seen in this age group.^[29]

It should also be considered that infants and young children are usually at high risks for hospital admission after respiratory tract contamination with viruses like influenza virus and Respiratory Syncytial Virus (RSV). Since the respiratory tract and immune system are not mature, it can lead to serious viral respiratory disease.^[30]

Children’s Behaviors to COVID-19

Kids are not insensitive to the significant influence of the COVID-19 outbreak. Children experience panic, uncertainty, and physical and social isolation and can miss school for a long time. Ability to understand children’s reactions and feelings is necessary to meet their needs properly.

The approaches recommended by Chinese pediatricians to parents contained boosting communication with children to meet panics and worries, playing group games to ease isolation, advocating activities that involve physical activity, and performing music therapy in the shape of singing to minimize the fear, worry, and tension that a child may feel. All steps are aimed at helping the child to get through this tough time. Parents should pay more attention to sleeping problems and nightmares, avoid increased daytime sleep, propose sleep hygiene and relaxation strategies, develop a positive psychological direction to alleviate stress, and shift attention to more efficient and positive attitudes.^[31]

Patient Management and Prevention of Contamination

On March 16, 2020, the American Dental Association suggested that dentists postpone all elective procedures and provide only dental emergency therapy.^[32] For suspected or confirmed cases of COVID-19, staff and dentists should observe the following guideline shown in Table 3 when dealing with urgent cases.^[1, 33]

Table 3. Necessary steps to be conducted during emergency treatments.

Step	Detail
1. Hand Hygiene	✓ Water + soap
	✓ Alcohol-Based Hand Rub (ABHR)
2. Personal Protective Equipment	✓ Protective glasses and face shield.
	✓ Face mask

3. Pre-procedural mouth rinse	<ul style="list-style-type: none"> ✓ 0.12% chlorhexidine ✓ 0.05% cetylpyridinium chloride for patients with a history of tongue stain or mucosal irritation.
4. Radiography	<ul style="list-style-type: none"> ✓ Panoramic or CBCT ✓ Double-covered sensors if intraoral radiography is necessary.
5. Rubber dam	<ul style="list-style-type: none"> ✓ Locate the rubber dam to cover the nose and reduce the SARS-CoV-2 transmission if possible.
6. Single-use tool	<ul style="list-style-type: none"> ✓ Syringes, mouth mirror, etc.
7. Aerosol production	<ul style="list-style-type: none"> ✓ Should be reduced by the application of hand instrumentation when it is possible.
8. Tooth extraction	<ul style="list-style-type: none"> ✓ Supine position
9. Salivary suction	<ul style="list-style-type: none"> ✓ Should be done carefully to prevent gag reflex.
10. Prescribing antibiotics and analgesics (acetaminophen)	<ul style="list-style-type: none"> ✓ For swelling and tooth pain to postpone the final treatment if possible.

General Anesthesia Cases

All hospitals are looking at elective surgeries and recommending or enforcing clinicians to triage them such that Operating Room (OR) staff are not under threat of unnecessary exposure to COVID-19. Pediatric dentists are advised to review pending cases to assess if children’s access to the OR should be postponed until this crisis lessens. Children having the pain of serious facial swelling or severe traumatic injury may need treatment under general anesthesia. The choice to offer the treatment relies on the patient’s condition, local limitations, and accessible alternative care strategies such as antibiotics and pain killers.^[34]

Special Tips for Pediatric Patients

1. Pedodontists should take into consideration using techniques that do not produce aerosol such as silver diamine fluoride (SDF), interim therapeutic restoration (ITR), alternative definitive

restorative techniques like Hall crowns, and frequent fluoride varnish fit into the quality of care spectrum post-pandemic.^[9]

2. Children are like adults in general, except that they are more likely to be neglected and contaminated in both community and individual environments.
3. It will be very difficult to control children's behavior during emergency treatment because the dentist's appearance becomes scary. The dentist can have several different shields so that the patient can choose one of the less scary.
4. Office environments should be free of all toys, books, and entertainment.
5. The fact that children are not alone in the office and their parents or companions in the same room increases the risk of infection.
6. Emphasis on not doing treatment in the first visit and the need to perform treatment according to the child's condition and severe pain.
7. Lack of patient cooperation results in parents' placement around the treatment team to help control the behavior and leads to more contamination of the assistant and the dentist.
8. Parents pay more attention to children in such situations and are more sensitive
9. Well, child visits should be scheduled in the morning, and sick child visits in the afternoon.
10. Patients' spatial separation should be performed by locating patients with sick visits in separate parts of the clinic or another place from patients with well visits.

3. Conclusion

Since preventing the transmission of SARS CoV-2 to children and transmission from infected children or parents to healthcare professionals is important, infection prevention checklists and all the points that this study prepared should be used by the whole dent pedodontists.

Conflict of Interest

The authors declared that there is no conflict of interest.

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