

Impact of COVID-19 Pandemic on Dental Treatment in Children: A Retrospective Cross-Sectional Analysis in Jeddah City

Rana A Alamoudi ¹, Shahad Basudan ², Mona Mahboub ², Khlood Baghlafl ¹

¹Pediatric Dentistry Department, Faculty of Dentistry, King Abdulaziz University, Jeddah, Saudi Arabia; ²General Dentist, Private Sector, Jeddah, Saudi Arabia

Correspondence: Rana A Alamoudi, Pediatric Dentistry Department, Faculty of Dentistry, King Abdulaziz University, Jeddah, 21589, Saudi Arabia, Tel +966-50-459-9971, Email rasalamoudi@kau.edu.sa

Background/Purpose: The novel coronavirus disease (COVID-19) outbreak has affected individuals worldwide. Considering the nature of dental treatments and direct exposure to saliva, blood, aerosols, or droplets from infected individuals, dentists are at significant risk of COVID-19 infection. Therefore, to decrease aerosol-generating procedures, minimally invasive dentistry (MID) is recommended during this pandemic. The goal of this research was to compare the flow of patients during a pandemic at a single university hospital in Jeddah City, Saudi Arabia, and to retrospectively assess the impact of the COVID-19 pandemic on pediatric dental treatments including MID.

Materials and Methods: This study was a retrospective cross-sectional analysis of pediatric patient records, dental procedures performed, and minimally invasive techniques using the database of the King Abdul-Aziz University Dental Hospital (R4) system during the period of COVID 19 pandemic compared to the same period in the previous year.

Results: During the COVID-19 pandemic, pediatric dental patient flow included only 699 patients compared to 1151 patients during the same period in the previous year. The most common pediatric dental procedures performed during the pandemic period were simple restorative treatments, including fissure sealants, followed by dental extractions, and fluoride varnish applications. During the pandemic period, more minimally invasive treatments were performed, including the Hall technique, silver diamine fluoride, resin infiltration, and atraumatic restorative techniques.

Conclusion: Based on this data, the COVID-19 pandemic had an impact on dental patient flow and the type of dental procedures performed on children. Minimally invasive treatments that minimize air generation are recommended; however, to establish the long-term effectiveness of minimally invasive treatments in pediatric dentistry, more follow-up studies with bigger sample sizes are required. More recommendations regarding conservative pediatric dental management after the COVID-19 era are suggested.

Keywords: coronavirus, cross-infection, aerosol, minimally invasive dentistry, MID, pediatric dentists

Introduction

In December 2019, a novel coronavirus known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was identified. The virus causes Coronavirus Disease 2019 (COVID-19), which originated in the city of Wuhan, China.¹ It is an unpredictable virus that has transmitted rapidly, infecting over 40.6 million people worldwide. The virus transmission from an infected person's droplets and aerosols released from the mouth or the nose while they are talking, breathing, coughing or sneezing.²

This pandemic, first targeting the communities of China, Europe, and the USA, continues to expand worldwide. The speed of global COVID-19 infection has increased significantly in a short period of time, and has presented a significant challenge to medical and dental schools.³ In response to the pandemic, the WHO considered the outbreak a public health emergency of international concern.¹

In Saudi Arabia, the first case was confirmed by the Ministry of Health on March 2, 2020. In order to limit the virus's transmission, major changes have been implemented in routine dental treatment.⁴ Since the beginning of the

epidemic, dentistry has been suspended in several nations worldwide, causing substantial disruptions in the availability of oral health services.⁵ In many regions, the COVID-19 pandemic has imposed a major strain on the healthcare system.⁶

Studies have shown that healthcare providers are considered at higher risk of contamination due to the nature of their work.⁷ Dental procedures require the dentist to be in close proximity to patients, which violates the recommended one-meter safe distance between individuals.⁸ Thus, the WHO has updated and added extra safety measures and protocols before and during treatment to minimize the spread of infection between the dentist, patient, and other healthcare workers.⁹ It is strictly forbidden to perform aerosol-generating procedures (AGPs), such as those that require the use of a handpiece.

An aerosol generating procedure is a medical procedure that creates liquid or solid particles in the air along with those created by the patient from breathing, coughing, sneezing, and talking.¹⁰ Droplet is usually large (>5 microns) aqueous bodies. However, the transmission of the COVID-19 virus has been proposed in relation to airborne (or aerosolized) transmission.¹¹

Considering the nature of dental treatments and direct exposure to saliva, blood, aerosols, or droplets from infected individuals, dentists are at significant risk of COVID-19 infection.⁹ Therefore, minimally invasive dentistry (MID) is recommended during this pandemic. MID is based on three main aspects: 1) understanding of disease etiology and prognosis; 2) oral healthcare measures taken either by the patient at home or by the dentist in the clinic; 3) the preservation of cavitated, carious teeth using preventative modalities.^{12,13} Several MID techniques are safe and high-quality alternatives to aerosol-generating procedures. These techniques involve pit and fissure sealants (PFS), resin infiltration (RI), silver diamine fluoride (SDF), Hall technique (HT), and atraumatic restorative technique (ART).

Worldwide, few studies had investigated the impact of COVID-19 pandemic on pediatric dental practice.^{14–16} However, at King Abdulaziz University Dental Hospital (KAUDH), no studies have been conducted to assess the impact of COVID-19 on dental treatments in pediatric patients. The null hypothesis was that COVID-19 pandemic has no impact on pediatric dental treatment. Therefore, the goal of this research was to assess the influence of the COVID-19 pandemic on pediatric dental treatment retrospectively and compare patient flow before and after the pandemic.

Materials and Methods

Study Design

The study design was a retrospective cross-sectional analysis, with ethical approval (#129-11-20), used to evaluate pediatric patient data and procedures performed during the pandemic period. All dental records of pediatric patients who attended dental clinics during the epidemic period between March 2020 and December 2020 were included. We included all pediatric dental patient records during the same period in the previous year (March 2019–December 2019) for comparison.

Study Technique

Data were retrieved from the electronic database (R4) of King Abdulaziz University Faculty of Dentistry (KAUFD). The data collected from the patients' files included patient demographic data, treatment providers, type of treatment provided, and progress notes. The inclusion criteria were children aged 14 years or younger who were assigned to emergency dental clinics or regular pediatric dental clinics who were classified as ASA I. The data was collected by one calibrated dentist through the electronic filing system. Retrospective analysis of the flow of pediatric dental patients during the epidemic period was performed and compared to the previous year. Additionally, the percentage of medically compromised patients and ASA classification were assessed. All medically compromised patients (ASA II and above) and patients treated or referred to GA were excluded from this study.

Statistical Analysis

All data were anonymized and saved on a password-encrypted desktop. The data were entered in an Excel sheet for more organization and for easier analysis and comparison. Then, the data were entered and analyzed using SPSS Statistical analysis version 22.0 (SPSS Inc., Chicago, IL, USA). Descriptive analysis reported the mean, frequencies, and percentages of the outcomes (treatment procedures) and the variables (demographic variables).

Results

Patient Flow and Demographic Characteristics

Table 1 shows the demographic data of pediatric dental patients during the COVID epidemic (2020) and the previous year (2019). At KAUDH, the flow of pediatric dental patients decreased by 60.7% compared to the

Table 1 Demographic Data of Pediatric Dental Patients During the COVID Epidemic in 2019 and 2020

Gender	Total Number 2019 (%)	Total Number 2020 (%)
Female	592 (51.4)	374 (53.5)
Male	559 (48.6)	325 (46.5)
Nationality		
Saudi	526 (45.7)	387 (55.4)
Non-Saudi	183 (15.9)	117 (16.7)
NR	442 (38.4)	194 (27.8)
Medical		
ASA I	905 (78.6)	563 (80.5)
ASA II	98 (8.5)	71 (10.2)
NR	148 (12.9)	65 (9.3)
Frankel behavioral scale		
Definitely negative (-ve)	69 (6)	27 (3.9)
Negative (-ve)	101 (8.8)	46 (6.6)
Positive (+ve)	395 (34.3)	238 (34)
Definitely positive (++ve)	346 (30.1)	277 (39.6)
NR	240 (20.9)	111 (15.9)
Treatment provider		
Student	354 (30.8)	202 (28.9)
General dentist	229 (19.9)	109 (15.6)
Postgraduate	315 (27.4)	283 (40.5)
Specialist or above	190 (16.5)	79 (11.3)
Others	63 (5.5)	26 (3.7)

Abbreviations: MID, minimally invasive dentistry; WHO, World Health Organization; AGP, aerosol-generating procedure; PFS, pit and fissure sealant; RI, resin infiltration; SDF, silver diamine fluoride; HT, Hall technique; ART, Atraumatic Restorative Technique; KAUFU, King Abdulaziz University Faculty of Dentistry; KAUDH, King Abdulaziz University Dental Hospital; NR, Not Reported.

2019

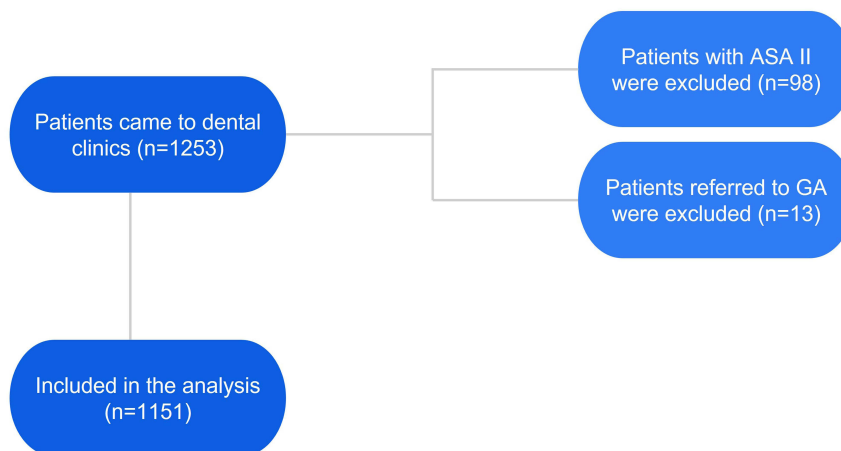


Figure 1 Inclusion and exclusion criteria for 2019.

2020

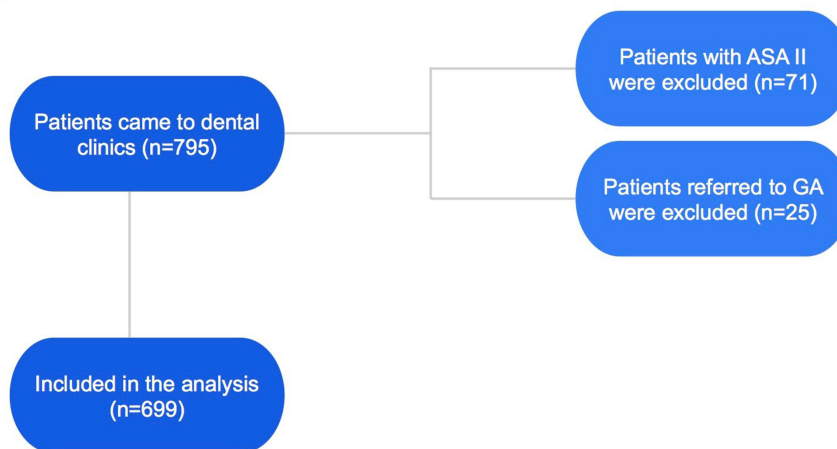


Figure 2 Inclusion and exclusion criteria for 2020.

previous year. During the COVID-19 period from March 2020 to December 2020, only 699 pediatric patients visited the clinic seeking dental treatment, compared to 1151 pediatric patients during the same period in the previous year (March 2019–December 2019).

In the COVID period (2020), a total of 71 pediatric patients were classified as ASA II, and 25 were referred to GA, compared to 98 pediatric patients classified as ASA II and 13 cases referred to GA in 2019 (Figures 1 and 2). However, there are no records of patients classified as ASA III and IV.

Out of 1151 patients in 2019, 621 (54%) were 8–11 years old, with a mean age at the time of treatment of 9.5 ± 2.5 . During the COVID period of 2020, out of 699 patients, 472 (67.7%) were 6–10 years old with a mean age at the time of treatment of 8.4 ± 2.6 .

Dental Procedures During COVID-19 Period

Figure 3 shows the number and percentage of pediatric dental procedures performed during the COVID-19 period compared to the same period in the previous year. The percentages of the treatments provided in the two years were comparable, but the most common procedure was performed during the COVID period compared to the previous year

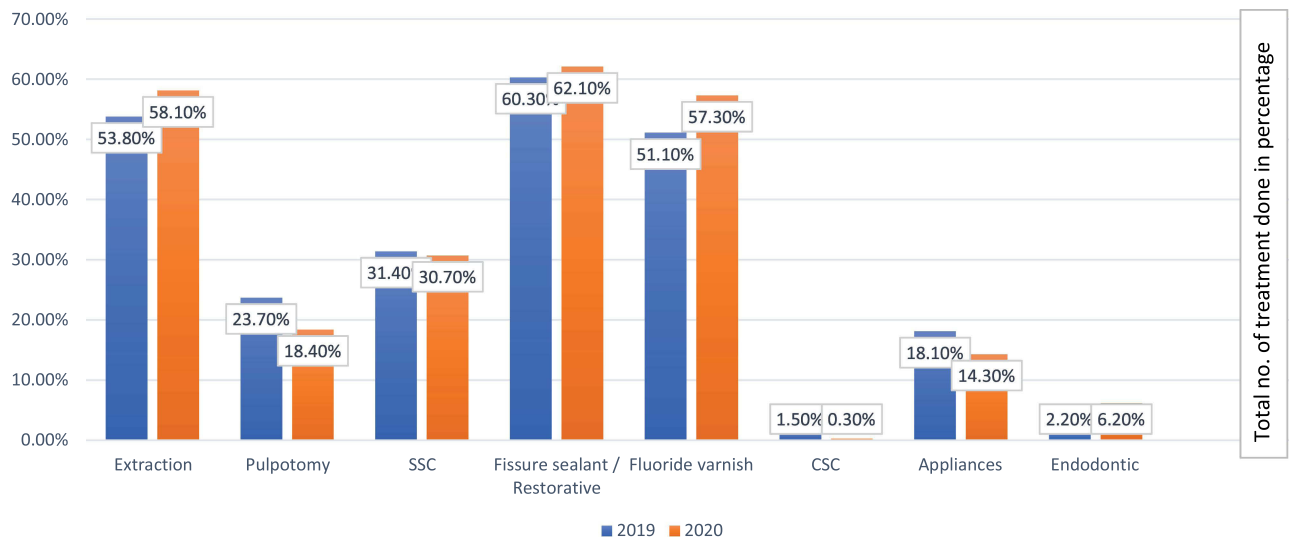


Figure 3 Comparison between regular dental procedures during COVID pandemic during (2020) and the previous year (2019).

was extraction, with 406 (58.10%) and 619 (53.80%) cases, respectively, while the least common procedure in both years was celluloid strip crowns, with 3 (0.30%) and 17 (1.50%) cases, respectively.

Minimally Invasive Procedures During COVID-19 Period

Figure 4 shows the number and percentage of minimally invasive procedures performed during the COVID-19 period compared to the same period in the previous year. During the epidemic period, the Hall technique and ART were used more frequently compared to the same period in the previous year. During the COVID-19 period, the most used technique was the Hall technique, representing 2.2% of the MID treatments used to restore teeth in 15 patients. The least common technique among MID treatments was ART, which was used for only three (0.3%) patients. During the epidemic period, only five (0.7%) patients were treated using SDF.

Discussion

This study was a retrospective cross-sectional study that aimed to assess the influence of the COVID-19 pandemic on pediatric dental treatment and compare patient flow before and after the pandemic. Additionally, to compare different

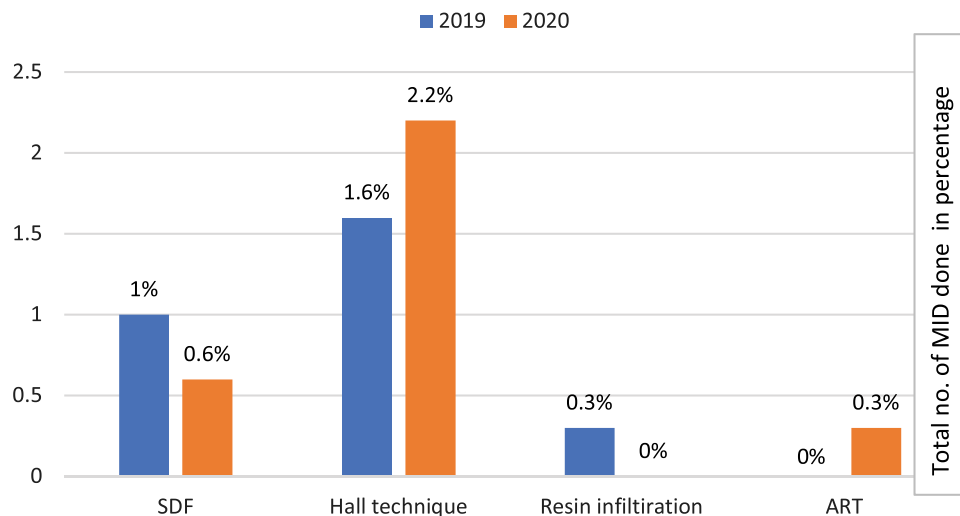


Figure 4 Comparison between MID procedures during COVID pandemic (2020) and the previous year (2019).

dental procedures performed, and minimally invasive techniques used during the COVID-19 period at a single university hospital in Saudi Arabia. Similarly to previous published studies in Egypt and China,^{17,18} the present results showed a reduction of dental care utilization services by children during the epidemic period.

Our findings showed an increase in the GA referral cases during the COVID period. Similarly a recent study conducted in UK,¹⁹ explained this increase in GA number as a parental response avoiding dental appointment during COVID pandemic unless their children reported severe dental symptoms. Previous studies have shown that the use of dental handpieces can increase the risk of exposure and transmission of COVID-19 between patients and healthcare workers; thus, the treatment provided to patients should be as minimally invasive as possible, without the use of handpieces, to lower the risk of infection transmission.^{20,21}

In Saudi Arabia, no study has evaluated the use of alternative, non-invasive dental treatments such as ART and SDF, as opposed to dental handpieces, in pediatric patients during the pandemic period. The Ministry of Health (MOH) guidelines recommended the use of conservative techniques to reduce the risk of aerosols during dental treatment.²² These techniques have been used to effectively restore primary carious teeth.^{13,23} A critical review for the clinical recommendations post COVID-19 by Alhalabi et al showed non-restorative treatment and minimally invasive restorative techniques that generate minimal aerosol are recommended in treating pediatric dental patients.²

The study findings showed that the SDF technique was applied in five (0.7%) pediatric dental patients during the epidemic. Several systematic reviews have assessed the effectiveness of SDF on primary teeth and found that SDF is superior to the other tested techniques in arresting dental caries. Studies have found that SDF is more effective than fluoride varnish and ART.^{23–29} In agreement with our study's aim, this study concluded that the use of SDF achieves the World Health Organization (WHO) goals for oral health, contributes to the reduction of caries activity, and provides a minimally invasive treatment method for clinics in pediatric specialties.

Our findings show that the Hall technique is the most common MID technique used during COVID-19. The results also showed that, during the pandemic period, pediatric patients were more frequently treated using the Hall technique compared to the same period in the previous year. The analysis revealed that most patients treated using the Hall technique were treated by postgraduate students. Undergraduate students might not have sufficient knowledge about the prognosis and success rate of the Hall technique. Several randomized clinical trials have assessed the Hall technique and the conventional method clinically and radiographically and found that the Hall technique was slightly superior compared to the conventional stainless steel preparation method.^{30–33}

However, the literature has reported that the Hall technique might temporarily affect occlusion due to the increase in the vertical dimension.^{34–36} Previous studies have reported that preformed metal crowns can cause an open bite, forcing the patient to cope with premature contact for a few weeks.³⁵ These studies also reported an increase in the occlusal vertical dimension post-operatively for a few weeks after cementation of the crown, and occlusion reestablished after 15–30 days.^{34–36} Other reported problems in pilot studies related to the Hall technique include TMJ symptoms, reduction in masseter muscle activity, and extrusion of newly erupted permanent molars.^{37,38}

Regarding the other MID techniques, our results show that the ART was used frequently during the pandemic period, but in the statistics of the previous year, no one used this technique. In Nigeria, a study evaluated the placement of ART restorations among primary school children, and after 12 weeks of follow-up, most restorations were sound and intact.³⁹

The main limitation of this study that it was conducted retrospectively. All clinical data was gathered through reviewing patient medical records, which resulted in underreporting of errors. The data collected from the system were taken from each patient's file individually, specifically from the progress notes written in their files. Some of the data and procedures were not written in sufficient detail for us to collect the information needed for the study, and some dentists did not write any progress notes, which may have affected our study results. One of the limitations of the study is that it was conducted in one dental center so generalizability could not be established. However, King Abdulaziz University Hospital is considered one of the main dental centers in the western region, which has followed the updated of the international dental guidelines. Despite these disadvantages, the data are in line with those of previous studies, which have reported that COVID-19 had an impact on dental flow and on the use of different MID techniques.

Conclusion

The main findings of this study showed that the flow of patients during the COVID-19 period decreased in comparison to the same period in the previous year. The most used minimally invasive dentistry techniques in the pandemic period were the Hall technique, followed by SDF, with a slight difference between them in the same year. More recommendations for minimally invasive dental techniques in pediatric dentistry after the COVID-19 era are suggested. Minimizing air-generating procedures and shifting to less invasive or non-invasive treatment methods is recommended. However, to establish the long-term effectiveness of COVID-19 on pediatric dental treatment, more follow-up studies with bigger sample sizes are required.

Ethics Approval and Informed Consent

This study was conducted according to the guidelines laid down in the declaration of Helsinki and all procedures involving research study documents were approved by the Institutional Review Board of King Abdulaziz University Research Committee (proposal number #129-11-20) in Jeddah, Saudi Arabia. The informed consent was waived for the current study by Institutional Review Board of King Abdulaziz University Research Committee due to the retrospective nature of the study.

Consent for Publication

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation. The authors declare that this paper was not published before.

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Disclosure

All authors report no conflicts of interest in this work.

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