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The impact of COVID-19 lockdown on maintenance of children's dental health

A questionnaire-based survey

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ABSTRACT

Background. The COVID-19 pandemic has been associated with several changes in maintenance of children's dental health. The aim of this study was to evaluate the extent of these changes.

Methods. Parents were asked to respond anonymously to a questionnaire regarding alterations in their children's oral habits, such as frequency of eating and drinking, toothbrushing, signs of stress, and receiving oral health care during the lockdown period. The participants were reached either during their visit to the clinics or via the social media groups of the authors.

Results. There were 308 parents of children aged 1 through 18 years who responded to the questionnaires. The authors found associations between increased frequency of eating and drinking, decreased frequency of toothbrushing, and postponing oral health care. Among the children, 11% experienced more frequent oral signs of stress, such as temporomandibular disorder and aphthous stomatitis, during the lockdown. Although children from all age groups ate and drank more frequently between meals, younger children received a diagnosis of carious lesions more often during the lockdown ($P = .015$).

Conclusions. During the lockdown, many children changed their eating, drinking, and toothbrushing habits and, thus, increased their risk of developing caries.

Practical Implications. During pandemic-associated re-care visits or recall visits, it is imperative to conduct a detailed interview regarding changes in oral health habits. In children at high risk, dentists recommended more diagnostic and preventive measures to prevent deterioration of their oral health. Moreover, dentists should put more emphasis on motivational interviewing to help children resume healthier routines after the lockdown.

Key Words. Toothbrushing; caries; dental; eating habits; treatment; periodic dental examination.
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COVID-19 was first reported in China in December 2019. It quickly spread to 181 countries (as of May 2020) and became a global pandemic, which affected millions of people worldwide. To reduce transmission, social distancing and lockdown were recommended.[1-3] During lockdown, several changes took place in the family routine: parents and children stayed at home, and the children received lessons via online learning applications, connected with friends by cell phones, spent their free time playing games on the computer, and did not attend social or physical activities. These lifestyle changes, together with the higher availability of food and drinks at home while playing on the computer or participating in online meetings, have led to increased frequency of meals and snacks and intake of sugary drinks during the COVID-19 pandemic.[4-6]

Moreover, possible changes in children's sleep routines (for example, waking up late in the morning and staying awake late at night) may have led to more frequent eating at night and reduced frequency of toothbrushing.[5,7] As a consequence, these children may have been at higher risk of developing new carious lesions.[8-13] An opposing possibility is that parental presence at home during the lockdown increased supervision of the children, leading to improved oral hygiene habits and consumption of more healthy food.[4,13]

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Another consequence of the COVID-19 outbreak is related to the warnings regarding the risk of receiving dental treatment during this period. During dental treatment, increased spread of aerosols while drilling and scaling, as well as the physical proximity between the dentists and their patients and between patients in the waiting room, may increase the risk of being infected by the virus.[14] As a result, the Centers for Disease Control and Prevention and several other health authorities around the world instructed dental staff members to treat only emergency cases during the COVID-19 pandemic and recommended the public to postpone nonessential dental treatments and periodic examinations.[1,15] Adhering to these warnings and fearing being infected, many parents may have postponed their children's dental appointments.[6]

Only 5 previous studies in the English language have evaluated the effect of COVID-19 lockdown on maintenance of children's oral health. Most of them did not assess the extent of these changes, referring instead to a dichotomic evaluation,[6,7,13] or did not compare the existing habits during the pandemic with those during the previous period.[5,7] Moreover, few of the studies included adolescents and concentrated on limited ranges of ages (3-6 years, 0-12 years, < 14 years, 6-12 years, or 3-15 years) and thus could not assess the effect of age on these changes.[4-7,13,14]

An additional issue in regard to the lockdown and staying at home to prevent spreading the disease is increase in emotional stress of the children,[4,7,15,16] which concomitantly could have been expressed orally via temporomandibular disorders (TMDs) or recurrent aphthous stomatitis (RAS). TMD affects the function of the temporomandibular joint along with the muscles of mastication.[17,18] It can be provoked by emotional depression, stress, anxiety, oral parafunction,[19,20] and even reduced sleep quality.[21] Moreover, patients with TMD are affected more commonly by anxiety and depression.[22] This disorder can affect 5% through 12% of the population, including children.

RAS is another oral expression of stress, affecting 5% through 25% of the population, and is characterized by periodic eruption of painful solitary or multiple ulcerations of the oral mucosa.[23,24] RAS can affect quality of life by affecting patients' speech, nutrition, physical appearance, self-esteem, and social interaction. Its onset is usually during childhood, with a peak onset from 10 through 19 years and with a tendency to diminish in frequency and severity with age.[25]

Although several previous studies have confirmed the relationship between emotional stress and anxiety and TMD and RAS,[4,7,17,26] to our knowledge, no study has evaluated the possible oral manifestation of the lockdown-related stress via onset of TMD or RAS.

We hypothesized that the COVID-19 lockdown might affect children's oral health and care. Accordingly, the aims of our study were to evaluate the impact of the COVID-19 lockdown on several parameters of children's maintenance of oral health (frequency of eating, drinking, toothbrushing, and receiving oral health care during and after the lockdown) and oral manifestation of stress, as well as the correlation between these variables and the child's age and oral health care providers.

METHODS

Study population and setting

We conducted this study during February and March 2021. Parents of children aged 1 through 18 years were asked to respond anonymously to a questionnaire regarding changes in maintenance of dental health and care and manifestation of stress-related oral symptoms during the COVID-19 lockdown. Before the study, the questionnaire was reviewed by all authors and validated by 15 parents to verify clarity and reliability.

The variables in the questionnaire included

- demographic data (such as sex and age)
- health condition of the child
- training of the attending dentist
- type of dental clinic that provided the service regularly (private clinic, health maintenance organization [HMO], hospital-associated dental clinic)
- presence of parents at home during the lockdown
- changes in timing and frequency of eating food (healthy and snacks) and drinking sugary drinks
- increase in weight
- changes in oral hygiene habits (frequency and timing of toothbrushing)
- manifestation of emotional stress (via TMD and RAS)

ABBREVIATION KEY

CPD: Certified pediatric dentist.
GP: General practitioner dentist.
HMO: Health maintenance organization.
RAS: Recurrent aphthous stomatitis.
TD: Teledentistry.
TMD: Temporomandibular disorder.

Table 1. Distribution of answers to the questionnaire regarding demographic characteristics of the study population.

VARIABLES	ANSWER OPTIONS	RESULTS, NO. (%)
Age, Y	< 6	69 (22.5)
	6-10	139 (45.3)
	≥ 11	99 (32.2)
Sex	Male	159 (51.8)
	Female	148 (48.2)
Health Condition	Healthy	267 (87.54)
	Developmental disorder	8 (2.62)
	Autism spectrum disorder or attention deficit/hyperactivity disorder	21 (6.9)
	Chronic diseases	8 (2.62)
	Chronic disease and autism spectrum disorder	1 (0.32)
Place of Receiving Routine Dental Treatments	Private dental clinics	170 (56.9)
	■ treated by a general practitioner	52 (17.4)
	■ treated by a certified pediatric dentist	118 (39.5)
	Public dental clinics	129 (43.1)
	■ health maintenance organization	119 (39.8)
	■ hospital	10 (3.3)

- changes in the maintenance of oral health (receiving periodic dental examination and treatment)
- reason for cancelation of dental treatment or periodic dental examination (fear of COVID-19, infection)
- need for urgent oral health care during pandemic and its availability (Tables 1-5).

The study population included parents of children who were treated regularly before the lockdown either in hospital-affiliated clinics, in HMO dental clinics, or in private clinics by general practitioner dentists (GPs) or certified pediatric dentists (CPDs). To include all these groups of parents, we reached them either during their visit to private dental clinics of CPDs, during their visit to a hospital-affiliated clinic, or via the authors' social media groups to reach parents whose children are treated regularly by GPs in HMOs or in private clinics. We considered the filling out of the questionnaire as informed consent.

In the clinics, the questionnaires were given to the parents by the secretary after the dental visit. If the parents arrived with several children, they were asked to fill out only a single questionnaire regarding 1 of their children, and they returned the questionnaires anonymously into a pool of returned questionnaires without any intervention of the dental staff members. For the electronic form, the participants completed the questionnaire anonymously and submitted it online. The institutional review board of the Sheba Medical Center (research 779-20-SMC) approved the study.

Statistical methods

We tabulated all study variables overall and by age groups and dental health care providers. We compared the categorical variables using the χ^2 test or Fisher exact test (when the numbers were small), and we compared the 1 continuous variable (age) among groups using analysis of variance. We examined correlations between variables using Kendall correlations owing to the large number of ties and tested for significance. We tested associations between variables using the χ^2 test (or Fisher exact test). In all tests performed, we considered P values below .05 statistically significant. We performed statistical analyses using R (Version 3.4.1; R Foundation for Statistical Computing).

Table 2. Distribution of answers to the questionnaire regarding presence of parents at home during COVID-19 lockdown.

VARIABLE	ANSWER OPTIONS	AGE GROUPS, NO. (%)			ANALYSIS OF VARIANCE *P* VALUE AMONG AGE GROUPS	TOTAL NO. (%)
		< 6 Y (n = 69)	6-10 Y (n = 139)	≥ 11 Y (n = 99)		
Presence of Parents at Home During COVID-19 Lockdown	Parents stayed at home only during the lockdown	55 (79.7)	97 (70.3)	56 (56.5)	.025	208 (68)
	Parents stayed at home regularly	7 (10.15)	15 (10.9)	17 (17.2)		39 (12.8)
	Parents worked away from home	7 (10.15)	26 (18.8)	26 (26.3)		59 (19.2)

RESULTS

Study population

Of all questionnaires, 145 were delivered to parents in 4 different private dental offices of CPDs after their child received a dental examination or treatment, and 240 were delivered electronically via the authors' social media groups.

In total, 308 parents responded to the questionnaire, with a total response rate of 80%. The response rate from the electronic delivery was 70.8% (170/240) and that of questionnaires delivered at the dental clinics was 95% (138/145). Of 170 parents of patients who were reached via social media group, only 3 claimed that their children were treated regularly by a CPD.

Demographic characteristics of the children

The mean (standard deviation) age of the children was 8.8 (3.6) years (range, 1-18 years). Of the total number of children, 159 (51.6%) were boys (the male to female ratio was 1.14:1). For analysis, we divided the children into 3 age groups: younger than 6 years (69 children); 6 through 10 years (139 children); and older than 11 years (99 adolescents). Tables 1 through 5 show the distribution of answers to the questionnaire regarding demographic characteristics of the study population and their dental health maintenance during the lockdown.

Presence of parents at home during COVID-19 lockdown

Significantly more parents of children younger than 11 years stayed at home during the lockdown than parents of older children ($P = .025$) (Table 2). Presence of parents at home was correlated positively with an increase in consuming healthy food more frequently between meals (0.1; $P = .05$) (Table 6).

Changes in eating and drinking habits during the COVID-19 lockdown

The distribution of children according to their changes in eating snacks and drinking sugary and carbonated drinks between meals is shown in Figure 1. Children from all age groups increased their frequency of consuming snacks and sugary drinks between meals. However, the magnitude of the increase was lower in the younger than the older children (≥ 11 years) for both snacks (Table 3, $P = .015$; Table 6, $P = .001$) and sugary drinks (Table 3, $P = .034$).

Eating healthy meals more frequently daily was positively associated with the presence of parents at home and negatively associated with changing the timing of toothbrushing (0.1, $P = .047$, and −12, $P = .031$, respectively) (Table 6).

Oral hygiene habits during the COVID-19 lockdown

Figure 2 shows who was responsible for brushing children's teeth during the COVID-19 lockdown according to the child's age. Significantly fewer children who received treatment in hospital settings brushed their teeth by themselves: 20% versus 51.9%, 63.6%, and 64.7% of the children treated by GPs at private clinics, by CPDs, or in HMO clinics, respectively ($P = .035$). The percentage of children who brushed their teeth by themselves increased with age (Table 4, $P < .001$). The changes in frequency of children's toothbrushing during the COVID-19 lockdown is shown in Figure 3. Children aged 6 through 10 years skipped their toothbrushing in the morning more frequently than younger or older children (Table 4, $P = .041$).

Table 3. Distribution of answers to the questionnaire regarding changes in eating and drinking habits during the COVID-19 lockdown.

VARIABLES	ANSWER OPTIONS	AGE GROUPS, NO. (%)			ANALYSIS OF VARIANCE *P* VALUE	TOTAL NO. (%)
		< 6 Y	6-10 Y	≥ 11 Y		
Did Your Child Eat More Times a Day Healthy Food During the COVID-19 Lockdown as Compared to the Previous Period?	Yes, ate 1-2 more times per day	37 (53.6)	49 (35.5)	44 (44.4)	.194	130 (42.5)
	Yes, ate 3-4 more times per day	6 (8.7)	17 (12.3)	13 (13.1)		36 (11.8)
	No, ate similar number of meals	24 (34.8)	67 (48.6)	36 (36.4)		127 (41.5)
	No, ate more orderly and less often per day	2 (2.9)	5 (3.6)	6 (6.1)		13 (4.2)
Did Your Child Eat More Times a Day Sweets, Snacks (Such as Cakes, Cookies, Waffles, Biscuits, Pretzels, Potato Chips, Cornflakes, et cetera) During the COVID-19 Lockdown as Compared to the Previous Period?	Yes, ate 1-2 more times per day	40 (58.0)	57 (41.0)	35 (35.4)	.015	132 (43)
	Yes, ate 3-4 more times per day	12 (17.4)	17 (12.2)	10 (10.1)		39 (12.7)
	Yes, ate even much more frequently	1 (1.4)	10 (7.2)	10 (10.1)		21 (6.8)
	No, ate similar number of meals	15 (21.7)	52 (37.4)	38 (38.4)		105 (34.2)
	No, ate more orderly and less often per day	1 (1.4)	3(2.2)	6 (6.1)		10 (3.3)
Did Your Child Eat His or Her Meals at a Different Timing During the COVID-19 Lockdown as Compared to the Previous Period?	1 Yes, ate more breakfasts during the COVID-19 lockdown	21 (31.3)	43 (30.9)	23 (23.2)	.097	87 (28.5)
	2 Yes, ate more meals/snacks in the late evening and at night	14 (20.9)	30 (21.6)	38 (38.4)		82 (26.9)
	3 No, there was no change in the timing of his or her meals during the COVID-19 lockdown	32 (47.8)	65 (46.8)	37 (37.4)		134 (44)
	1 + 2	0 (0.0)	1 (0.7)	1 (1.0)		2 (0.6)
Did Your Child Drink More Frequently Sugary/Carbonated/ Juices/Soda Between Meals During the COVID-19 Lockdown as Compared to the Previous Period?	Yes, consumed 1-2 more times per day	18 (26.1)	15 (10.9)	11 (11.1)	.034	44 (14.4)
	Yes, consumed 3-4 more times per day	4 (5.8)	7 (5.1)	4 (4.0)		15 (4.9)
	Yes, consumed even much more frequently	2 (2.9)	4 (2.9)	9 (9.1)		15 (4.9)
	No, consumed at similar frequency	42 (60.9)	107 (77.5)	69 (69.7)		218 (71.2)
	No, consumed less frequently	3 (4.3)	5 (3.6)	6 (6.1)		14 (4.6)
Did Your Child Gain Weight During the COVID-19 Lockdown?	Yes	6 (8.8)	32 (23.2)	21 (21.65)	.036	59 (19.5)
	No	42 (61.8)	76 (55.1)	55 (56.7)		173 (57.1)
	Maybe, but the child was not weighed	11 (16.2)	25 (18.1)	17 (17.53)		53 (17.5)
	I don't know	9 (13.2)	5 (3.6)	4 (4.12)		18 (5.9)

The effect of dental caregiver on maintenance of oral health of children during the COVID-19 lockdown

Only 30% of the patients treated in hospital-related clinics were healthy, whereas 82.4%, 89.8%, and 91.5% of the children treated by GPs at private clinics, in HMOs, and by CPDs were healthy, respectively ($P = .001$). Similarly, 90% of the patients treated in hospital-related clinics claimed

Table 4. Distribution of answers to the questionnaire regarding deterioration of oral hygiene habits during the COVID-19 lockdown.

VARIABLES	ANSWER OPTIONS	AGE GROUPS, NO. (%)			ANALYSIS OF VARIANCE *P* VALUE	TOTAL NO. (%)
		< 6 Y	6-10 Y	≥ 11 Y		
Who Routinely Brushes Your Child's Teeth?	Child himself	6 (8.7)	85 (61.2)	91 (91.9)	< .001	182 (59.3)
	The parents	27 (39.1)	21 (15.1)	2 (2.0)		50 (16.3)
	The child and parents alternately	36 (52.2)	33 (23.7)	6 (6.1)		75 (24.4)
Did Your Child Brush His or Her Teeth Fewer Times a Day During the COVID-19 Lockdown?	Yes, less often in the mornings	8 (11.8)	22 (15.83)	8 (8.1)	.041	38 (12.42)
	Yes, less often in the evenings	3 (4.4)	6 (4.31)	7 (7.1)		16 (5.23)
	Yes, less times in the mornings and evenings	2 (2.9)	7 (5.04)	14 (14.1)		23 (7.52)
	No, my child brushed his or her teeth the same frequency as before.	55 (80.9)	104 (74.82)	70 (70.7)		229 (74.83)
Was Toothbrushing Timing Changed During the Lockdown Days?	Yes	12 (17.4)	38 (27.3)	33 (33.3)	.072	83 (27.0)
	No	57 (82.6)	101 (72.7)	66 (66.7)		224 (73)

that they consumed daily medications, whereas 17.3%, 18.6%, and 7.6% of the children treated by GPs at private clinics, in HMOs, or by CPDs claimed that they consumed daily medication, respectively ($P = .038$).

Regarding toothbrushing frequency, significantly fewer children treated in hospital-related clinics brushed their teeth by themselves (20%) compared with other groups (51.9%, 64.7%, and 63.6% of children who were treated by GPs at private clinics, in HMOs, or by CPDs, respectively; $P = .035$).

More carious lesions were diagnosed in children treated in hospital-related clinics (20%) than in children treated by GPs at private clinics (5.8%), in HMOs (11.0%), or by CPDs (11.2%) ($P = .002$). Children treated by GPs in private clinics received a diagnosis of carious lesions significantly less often than children treated by GPs in HMOs or children treated by CPDs (5.8% versus 11.0% and 11.2%, respectively; $P = .002$).

Significantly more children treated in hospital-affiliated clinics reported symptoms of TMD for the first time than children treated by GPs at private clinics, in HMOs, or by CPDs (10% versus 3.8%, 5%, and 2.5%, respectively; $P < .001$).

Receiving oral health care during the COVID-19 pandemic

Table 5 summarizes the distribution of answers regarding receiving or canceling dental examination or treatment during the COVID-19 pandemic. Among the study children, 76 (24.9%) claimed that they have not yet visited their dentists since the start of the COVID-19 lockdown, and only 56.7% received regular dental examinations. Among those, 14% received a diagnosis of more carious lesions during the last dental examination than before. New carious lesions were diagnosed more frequently in younger children. For the age groups younger than 6 years, 6 through 10 years, and 11 years and older, the percentages of children who received diagnoses of new carious lesions were 16.25%, 10.1%, and 7.2%, respectively ($P = .007$).

Regarding receiving dental treatment during the pandemic, 46 (15%) reported that they canceled an appointment for treatment, and 19 (6.2%) would have canceled their appointment if they had one.

Oral manifestation of emotional stress during the pandemic lockdown

According to the questionnaire responses, 3.9% of the children had, for the first time, symptoms of TMD during the pandemic lockdown, and 1 patient (0.3%) had symptoms of TMD more frequently than the period before the lockdown. Furthermore, 6.8% of the children experienced RAS for the first time. Symptoms of TMD or RAS were not correlated with age.

Table 5. Distribution of answers to the questionnaire regarding receiving or canceling dental appointments and treatment during the COVID-19 pandemic.

VARIABLES	ANSWER OPTIONS	TOTAL NO. (%)
Canceled or Postponed Dental Examination During the COVID-19 Lockdown	Yes	70 (22.8)
	No	174 (56.7)
	We did not have an appointment, but if we had, we would not have canceled it	44 (14.3)
	We did not have an appointment, but if we had, we would have canceled it	19 (6.2)
Canceled or Postponed Dental Treatment During the Lockdown	Yes	46 (15.03)
	No	192 (62.75)
	We did not have an appointment, but if we had, we would not have canceled it	49 (16.01)
	We did not have an appointment for treatment, but if we had, we would have canceled it	19 (6.21)
Need of Urgent Oral Health Care During the COVID-19 Lockdown	Yes	44 (14.3)
	No	264 (85.7)
Availability of Urgent Oral Health Care	It was easy to schedule an appointment	119 (78.8)
	We had difficulties in scheduling an appointment and were referred to a large medical center	22 (14.6)
	We were unable to schedule an appointment	10 (6.6)
Diagnosis of New Carious Lesions After the Lockdown	Have not visited the child's dentist since the lockdown	76 (24.9)
	Visited their dentist:	
	■ The dentist diagnosed more carious lesions than usual	32 (10.5)
	■ The dentist did not diagnose more carious lesions than usual	197 (64.6)

DISCUSSION

The aim of our study was to assess the effect of the COVID-19 lockdown on children's oral health. One aspect of maintaining good oral health is limiting the frequency of eating food (healthy and snacks) and drinking sugary drinks to 6 times a day. In our survey, we found that 62.7% of the children reported increasing the number of meals or snacks per day by 1 through 2 times, 3 through 4 times, or even more. In contrast, 54.4% of the children increased their frequency of consuming healthy meals. Despite the presence of parents at home, only 3.2% through 4.2% of the children decreased their frequency of consuming snacks or healthy meals per day. Our findings are in accordance with those of others researchers who have found that approximately 61% of children in kindergarten and school consumed more snacks during the lockdown,[4,6] and only 4.6% of the children younger than 14 years decreased their frequency of a cariogenic diet.[5]

Our finding regarding increased consumption of sugary and carbonated drinks during the pandemic is novel and important because this behavior may increase the risk of developing caries significantly.[14] Children in all age groups increased their frequency of consuming snacks and sugary drinks between meals, although the magnitude of the increase was more profound in the older age group. In contrast, carious lesions were diagnosed more frequently in children younger than 6 years. These findings may be related to the lower effectiveness of toothbrushing among the younger children or to the fact that these children usually use toothpaste containing low fluoride concentration (< 1,000 parts per million) owing to the taste. These findings may have implications for dentists during the examination appointments of children in general and younger children in particular.

Table 6. Kendall correlations between alteration in consuming food and sugary drinks between meals and maintenance of oral hygiene and dental treatment during the COVID-19 lockdown.

VARIABLES RELATED TO MAINTENANCE OF ORAL HYGIENE AND HEALTH	VARIABLES RELATED TO ALTERATION IN CONSUMING FOOD AND SUGARY DRINKS DURING THE COVID-19 PANDEMIC		
	Consuming More Frequently Healthy Meals Per Day τ Value (*P* Value)*	**Consuming More Frequently Snacks and Sweets Per Day τ Value (*P* Value)***	**Drinking More Sugary Drinks Between Meals τ Value (*P* Value)***
Child's Age	0.019 (.68)	0.17 (< .001)	0.07 (.11)
Parents Stayed at Home During COVID-19 Lockdown	0.1 (.047)	0.041 (.43)	0.0725 (.17)
Parents Brush the Child's Teeth	0.0142 (.78)	−0.11 (.03)	−0.05 (.33)
Child Decreased Frequency of Toothbrushing	0.019 (.71)	0.068 (.19)	0.168 (.001)
Child Changed the Timing of Toothbrushing	−0.12 (.031)	−0.1 (.07)	−0.11 (.04)
Parents Postpone Periodic Examination	0.0456 (.009)	−0.0162 (.80)	0.0162 (.34)
Parents Postpone Treatment	0.058 (.044)	−0.053 (.63)	−0.0080 (.49)

* *P* values via χ^2 or Fisher exact tests.

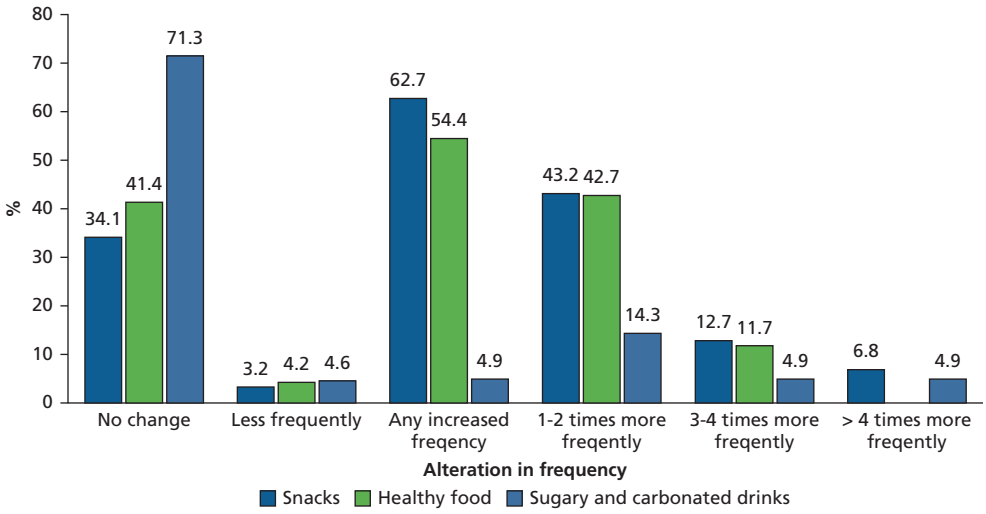


Figure 1. Alteration in the frequency of consuming snacks and healthy food and drinking sugary and carbonated drinks between meals by children during the COVID-19 lockdown relative to the previous period.

An additional negative effect of consuming more snacks and meals per day and staying at home without performing physical activities is gaining weight. Indeed, 37.2% of the parents reported that they knew for sure or suspected that their child gained weight during the lockdown period. These changes cause deterioration not only in dental health but also in systemic health, and, therefore, they reinforce the need to address the issue with parents and children.

Another aspect of maintenance of oral health is the frequency of toothbrushing. We found that 25.1% of the children decreased their frequency of toothbrushing in the morning, evening, or both. These findings are in accordance with 2 other studies that found that 22.9% and 21.9% of children decreased their frequency of toothbrushings[4,7] However, these results are slightly better than those reported by Baptista and colleagues,[7] who found that 42.7% of the children aged 3 through 15 years changed their oral hygiene habits. The decreased frequency of toothbrushing reported in our study was greater among older children who brush their teeth by themselves (Fisher test, $P = .0036$). These children also changed their timing of toothbrushing more frequently than children younger than 6 years ($P = .072$; Table 4). Accordingly, it could be speculated that alteration in the daily routine also may have an impact on the deterioration in maintaining oral hygiene.

In our study, which was conducted 1 year after the beginning of the pandemic, we found that 24.9% of the children still had not received a dental examination and 15% had not yet received any

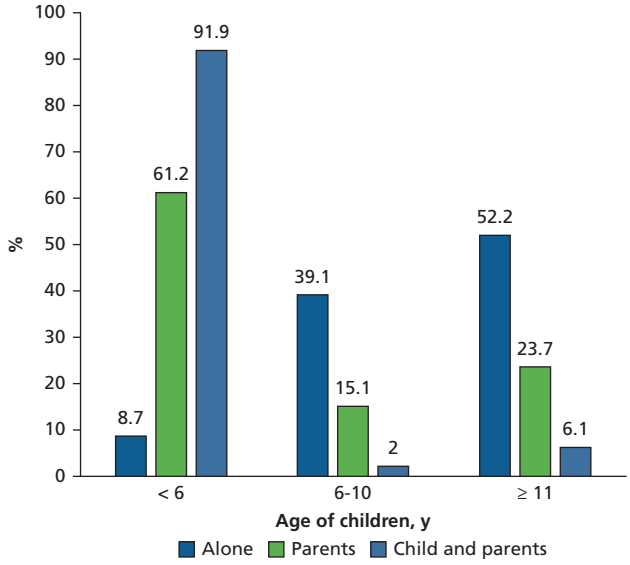


Figure 2. Distribution of children according to their age and according to who brushed their teeth.

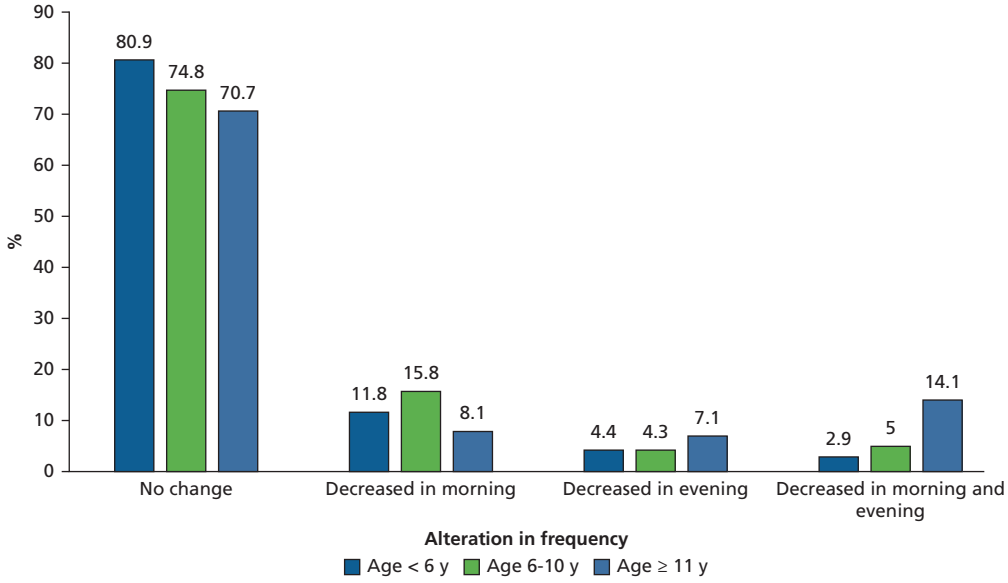


Figure 3. Alteration in the frequency of children's toothbrushing during the COVID-19 lockdown.

dental treatment. A dental examination, in addition to diagnosing new development of carious lesions, usually is accompanied by preventive treatments such as application and repair of fissure sealants and topical fluoridation. Skipping these treatments may further increase the risk of developing caries. Indeed, 14% of the children who visited their dentist after the lockdown periods received a diagnosis of more carious lesions than in previous years. Accordingly, we recommend that dentists make a focused effort during dental examinations to conduct a detailed interview regarding changes in food consumption and toothbrushing habits, as well as take steps to increase the ability to diagnose (such as obtaining more frequent bite-wing radiographs) and prevent caries.

Because the pandemic is ongoing, dentists should consider using teledentistry (TD). TD involves the exchange of clinical information and images over remote distances for dental consultations and treatment planning. TD offers several advantages in the dental examination and suggestion of emergency treatment in patients without involving the risk of being infected by COVID-19.[27] Accordingly, TD can be used for patients who need emergency examinations or treatment for

alleviating pain or infection. TD can also be useful also for providing instructions for home care of injured teeth and tissues for optimal healing.

Another adverse effect of the COVID-19 pandemic has been increased emotional stress of the children, which has been expressed via reports of first-time symptoms of TMD or RAS during the lockdown in all age groups. Accordingly, symptoms of TMD and RAS may serve as an indicator for children's emotional status and the need for emotional support during times of crisis, such as the COVID-19 pandemic.

The main limitation of our study is inherent to the study design: the use of a parent-reported questionnaire, which may lead to misreporting of data. However, the information our study provides will help design strategies in the prevention and care of children for oral damage caused during confinement due to the pandemic.

CONCLUSIONS

Pediatric dentists should be aware of the changes in children's oral hygiene maintenance during the COVID-19 pandemic and their consequences on children's dental health. Therefore, we recommend comprehensive habit evaluation, dental examination, instructions, and prevention. We also suggest that further similar long-term studies in other locations be conducted to extend the findings from our study in other populations. ■

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