

Impact of the COVID-19 pandemic on pro-health behaviors in the field of oral health, hygiene habits and attitude to dental care among Polish children and youth in the opinion of their parents

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ABSTRACT

Introduction: The turn of 2019 and 2020, during the COVID-19 pandemic caused by the SARS-CoV-2, saw major changes in the health sector, including the functioning of dental offices. Many of them were closed for several months, while others limited admission to emergencies only. In Poland, access to a dentist was therefore reduced for a considerable time. This may have contributed to the deterioration of the patients' oral health. The aim of the study was to assess the impact of the COVID-19 pandemic on pro-health behaviors regarding the oral health of children and their visits to dental offices in the opinion of their parents.

Materials and methods: A questionnaire survey was conducted with 103 parents of children aged 0–18.

Results: The study showed that the pandemic has affected the health sector and oral health. New devices and materials have appeared in dental offices that increase patient safety and reduce the risk of COVID-19 infection; 84.3% of respondents felt safe

in them, and 56% noticed new elements related to safety. The frequency of visits to dental offices decreased in most of the respondents. The reasons included the parents' lack of time (17.6%), lack of available visits (6.9%), and fear of infection (13.7%). During the pandemic, the oral hygiene condition of 59.3% of children was maintained at the same level, and deteriorated for 15.5%; 62.2% of children did not change their diet, while the deterioration of dietary habits affected 19.4% of the respondents. The main source (67%) from which parents obtained knowledge about fluoride was the Internet.

Conclusions: During the COVID-19 pandemic, most children did not change their dietary and hygienic behavior. The frequency of children's follow-up visits has decreased, which may contribute to the deterioration of their oral health.

Keywords: children; dietary habits; oral hygiene; SARS-CoV-2; COVID-19.

INTRODUCTION

COVID-19 disease is an infectious disease caused by the SARS-CoV-2, which, causing severe acute respiratory distress syndrome, can lead to serious complications, even to the death of the patient. People can become infected mainly by droplet infection, and the average incubation time for the initial variants was 5–14 days. The high contagiousness of the disease is caused by its initial asymptomatic course, which means that carriers who are unaware of their own infection spread the virus to a larger number of people [1]. The first reports of the virus appeared in Wuhan (China) on November 17, 2019, and 6 months later, on March 11, 2020, the WHO recognized the COVID-19 epidemic as a pandemic. It should be borne in mind that the interest in the virus is wave-like. Semantic analysis showed that the most frequently searched topics focus on the areas of threat, fear and prevention. Due to the route of transmission of the virus, dental offices, where most procedures are carried out in direct contact with water aerosol, have been recognized as places with a high risk of infection (not only because of the specificity of the procedures but also due to the high probability of infection

between patients, staff and physicians in a given facility) [2]. In Poland, this resulted in the temporary closure of many dental offices or the limitation of visits only to emergency and urgent cases. Delayed visits to the dentist can result in a deterioration of the oral health of patients. Data from monitoring studies conducted in Poland before the pandemic confirm the cumulative increase in the frequency of caries with the age of the respondents – from 53.8% in 3-year-old children to 93.9% in 18-year-old adolescents [3]. There is a decrease in the frequency and intensity of caries in the group of 12-year-olds, but this is an apparent reduction resulting from the replacement of teeth [4]. Due to these high rates of caries, it is necessary to regularly monitor and educate patients in the field of diet and hygiene, implement preventive measures and treat caries as early as possible. Hygienic and dietary negligence, and lack of access to a dentist, lack of prophylaxis at a young age can lead to serious dysfunctions of the entire masticatory system. The aim of the study was to assess the impact of the COVID-19 pandemic on the diet, oral hygiene, and dental treatment of children and their parents' health awareness.

MATERIALS AND METHODS

One hundred three parents/guardians with children aged 0–18 participated in the survey based on our own study. The survey was available as a link in Google Forms on the Internet and in paper form at the Paediatric Dentistry Clinic UDC Pomeranian Medical University in Szczecin (Poland). Twenty-four multiple and single-choice questions were asked of participants. These questions queried parents about the frequency and reasons for visits to the dentist with their child, changes in pro-health behaviors regarding the oral cavity, and possible changes in dental practices during the pandemic. The study was also intended to find out whether the child’s possible illness with a virus infection affected the oral health and what attitude parents have toward fluoride-containing agents.

RESULTS

The age distribution of children is presented in Figure 1.

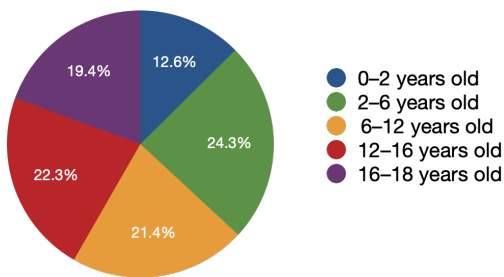


FIGURE 1. Age distribution of children

The answers of the respondents to the question about the frequency of visits to the dentist during the pandemic are presented in Figure 2 – 27.2% of children did not attend any visit during the pandemic/lockdown. A similar percentage of carers (28.2%) declared 1 visit a year.

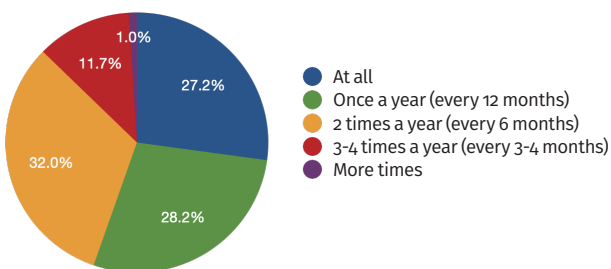


FIGURE 2. Frequency of visits to the dentist during the pandemic

The frequency of visits did not change for 30% of the respondents’ children and a similar percentage (31.4%) could not indicate a specific reason for a limited number of visits during the pandemic. For 13.7% of the respondents, the reason was the fear of infection (Fig. 3).

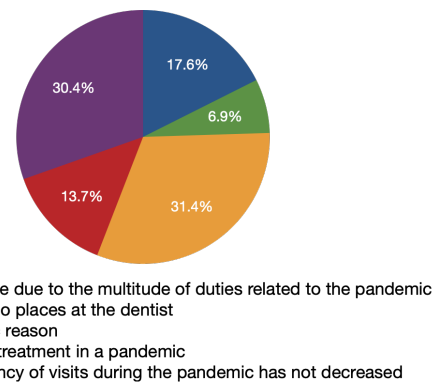


FIGURE 3. Reasons for reducing the frequency of dental visits during the pandemic

Every fifth child (19%) came to the surgery because of sudden pain or post-traumatic situation. On the other hand, more than 1/2 of the children (60.8%) presented for the continuation of planned treatment or a follow-up visit (Fig. 4).

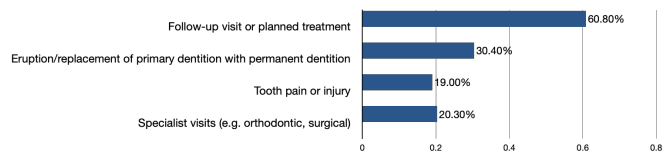


FIGURE 4. Reasons for visiting the dentist during the pandemic

The parents’ answers to the question of how the infection affected the oral health of children who contracted COVID-19 are presented in Table 1. Among the changes occurring in the oral cavity, the respondents most often mentioned single aphthae, pustules, engorgement, discoloration or single eruptions, which after time were cured.

Two questions in the survey concerned patient safety during a pandemic during a visit to the dentist’s office. The overwhelming majority of respondents (84.3%) felt safe in them. People who were afraid of a visit, as the main reason, indicated the possibility of COVID-19 infection as a result of contact with the dentist, other children and parents. More than half of the parents (56%) noticed new equipment, materials and/or equipment in the office, which increased their safety during the visit.

Brushing teeth twice a day by children was declared by 58.3%, and once a day by 26.2% of the respondents (Fig. 5).

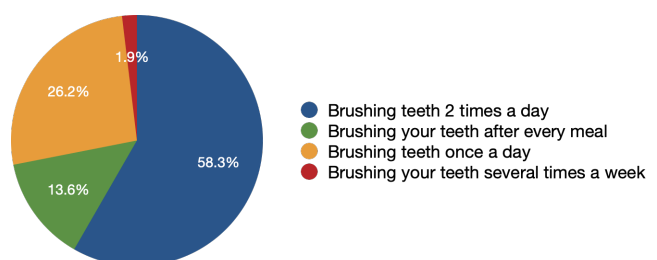


FIGURE 5. Frequency of brushing teeth during the pandemic

TABLE 1. Parents' answers to the survey questions

Has your child contracted COVID-19?	Yes (38.8%)	No (27.2%)	I don't know (34%)	
Has the COVID-19 infection affected your child's oral health?	yes (10.0%)	no (60.0%)	I don't know (30.0%)	
Do you feel safe coming to the dental office for a visit?	yes (84.3%)	no (2.0%)	not completely (13.7%)	
When was your child's last visit to the dentist?	a month ago (29.5%)	3 months ago (25.3%)	half a year ago (13.7%)	a year ago or more (31.6%)
What does your child use for daily oral hygiene, apart from toothpaste?	interdental threads (5.8%)	rinses for daily mouthwash (17.5%)	interdental floss and rinses for daily mouthwash (4.9%)	I do not use additional measures (only paste) (71.2%)

Nearly 60% of parents believed that their children's oral hygiene was maintained at the same level during the pandemic, and a similar percentage declared that their children's dietary habits had not changed either (Fig. 6, 7, 8).

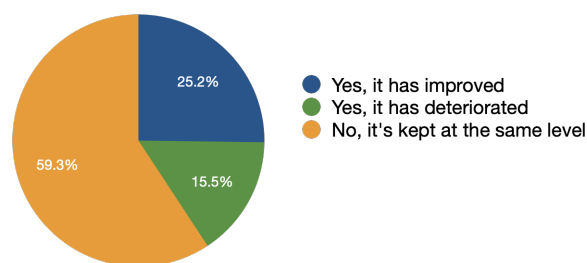


FIGURE 6. Change in children's oral hygiene during the pandemic

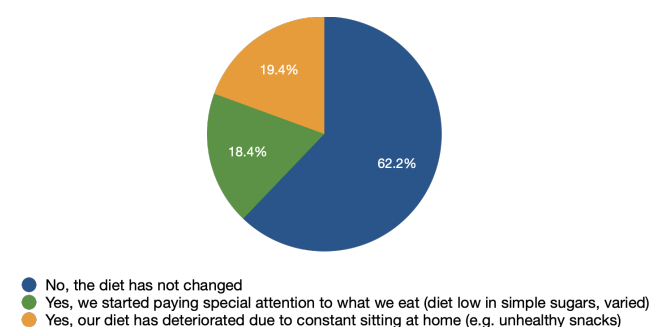


FIGURE 7. Presence and possible causes of changes in nutrition during the pandemic

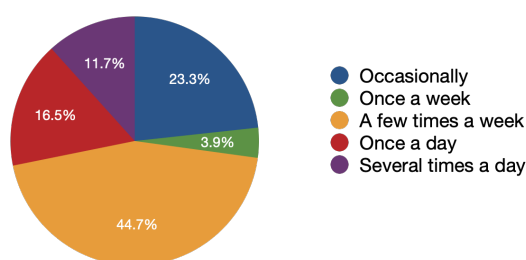


FIGURE 8. Frequency of consumption of sweet snacks and/or drinks

The last portion of questions concerned the use of fluoride (Tab. 2). Every fifth child (19.4%) brushed their teeth with fluoride toothpaste, recommended by a dentist. Nearly 60% of the respondents, when choosing a toothpaste for a child, were guided only by the age indicated on the packaging, without checking its composition. Fluoride-free toothpaste was used by 11.7% of children, and 10.7% of the respondents used toothpaste with reduced fluoride content in their children.

TABLE 2. Parents' responses to fluoride survey questions

	Yes (%)	No (%)
In your opinion, is the use of fluoride safe?	83.5	16.5
Did the doctor explain to you the principles of fluoride use?	36.9	63.1

Most of the parents (67%) obtained information about fluoride from the Internet (Fig. 9).

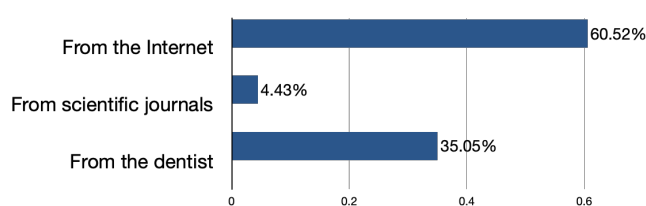


FIGURE 9. Sources from which parents/guardians obtain information about fluoride

DISCUSSION

The COVID-19 pandemic has had a huge impact on the everyday life of Polish people. Everyone had to adapt to the new reality. This particularly affected parents who, due to the closure of teaching facilities and the need to switch from normal working mode to remote one, had problems reconciling everyday life with the dental treatment of children. Fear of possible infection was the reason for the limited number of visits for some, and the closure of dental offices limited access to dentists for those who

were not afraid of infection. In the early period of the COVID-19 pandemic in the USA, the oral health of children deteriorated. According to Lyu and Wehby, this was due, among other things, to reduced access to specialist medical care. Based on the National Survey of Children's Health (a nationally representative cross-sectional survey conducted to obtain information on several aspects of children's health and health care) results in 2020, 75% of children had poor dental health compared to 2019 [5]. In addition, it was reported that children were 16% less likely to retain perfect teeth. These differences were noticed mainly in socio-economic and demographic subgroups, while in previous years such differences did not occur. This may indicate an indirect impact of the pandemic on the condition of children's teeth, by lowering parents' earnings and closing facilities in individual regions of the country. Our research showed a decrease in the number of dental check-ups during the pandemic. Only 30% of children did not limit the frequency of visits. Unfortunately, as many as 27.2% did not attend any visits, while another 28.2% had fewer visits. In the study by Sari and Bilmez, the percentage of patients hesitant to visit the dentist was 50.4% [6]. Caregivers of children in the Pittsburgh study reported that the greatest need not met during the pandemic was dental care (16%). On the other hand, general medical care and vaccinations were the most important unmet need for 5% of the respondents [7]. This demonstrates the importance of adequate access to the dentist for children's health.

It is surprising that only 13.7% of parents resigned from their child's visits to the dentist for fear of infection. For 17.6%, finding time in the modified day schedules was a problem. One in 3 could not give a specific reason why they limited the frequency of visits to the dentist. It is possible that one of the reasons was the increase in prices for dental services, related to the mandatory purchase of additional personal protective equipment by dentists. It is also possible that parents' earnings decreased as a result of the pandemic, as reported by Lyu and Wehby [5].

The fact that dentists were unavailable due to their infection with the virus could also have reduced the number of visits. According to research by Goriuc et al., the dental staff was severely affected by the COVID-19 pandemic [8]. However, as indicated by the data presented by the Campus et al., despite the increased exposure of dental staff to the virus, the incidence of COVID-19 among dentists did not differ significantly from that reported for the general population in a given country [9].

The increase in the cost of treating patients and the doctors' fear of infection caused the temporary closure of many dental facilities, which made it difficult for patients to make appointments. Maintaining regular visits ensuring the continuity of the prophylactic and therapeutic process has a huge impact on oral health. In the prevention of caries, regular visits to the dentist's office are as important as performing hygienic procedures at home and following a balanced, healthy diet [3, 4]. The results of monitoring studies [3] have shown that regular and frequent follow-up visits are correlated with the occurrence and severity of caries (negative index values). In addition, a relationship was found between the treatment rate and hygiene and dietary behaviors. Reducing the frequency of visits may worsen oral health indicators in the long term.

Safety at dental offices was one of the issues that affected parents visiting the dentist during the pandemic. Our own research shows that as many as 84.3% of the respondents felt safe coming to the dentist. Only every sixth parent (15.7%) was partially or completely afraid of infection. In the study of Sharma et al., the percentage of parents who were afraid of COVID-19 infection was much higher (37%) [10]. According to respondents from Italy, dental offices were and still are places with an increased risk of contracting COVID-19, and despite the improvement of the pandemic situation in 2021, as many as 16% of them did not return to dental treatment [11]. The research of the COVIDental Collaboration Group shows that COVID-19 did not significantly affect the provision of children's oral health services, despite the fact that access to visits was significantly limited [9].

The profession of a dentist has been recognized as a high-risk profession, mainly due to the conditions in the offices and the ways of spreading the virus. Infection can occur directly, i.e. through the transmission of the virus between the staff and the patient, or indirectly, i.e. by leaving droplets containing the virus on tools or surfaces [12]. The infection is influenced by the necessity of continuous work in the water aerosol environment. In order to reduce transmission of the virus, patients should rinse their mouths before or at the beginning of the visit. A recent study [13] has shown that rinses with chlorhexidine are ineffective against coronavirus. However, it is sensitive to agents with oxidizing properties and for pre-treatment oral disinfection, the following are recommended: 1% hydrogen peroxide or 0.2% povidone [14].

The data obtained in the survey show that the least common reason for visiting the dental office was tooth pain and trauma. During the lockdown period, sports facilities were closed and the possibility of using public space facilities was significantly limited. Children and teenagers were less active, and did not practice sports, so there were fewer accidents and injuries. In the studies of Olszewska et al., no differences in the frequency of extractions were noted between April 2019 and April 2020, but a significant increase in temporary fillings in primary and permanent teeth was observed: from 6.4% in 2019 to 19.3% in 2020, despite the fact that the total number of procedures performed at that time decreased [15]. This may indicate a change in the nature of visits to a more interventional one, instead of planned full treatment, and/or an increase in the intensity of caries in children. Similar research results were presented by Matsuyama et al., who compared data obtained from school dentists. They showed that the intensity of dental caries in children slightly increased after the pandemic [16].

Diet has a huge impact on the proper development of teeth in children [3, 4]. It is important to educate parents about the cariogenic effects of carbohydrates, the content of which in children's diets is alarmingly increasing. This fact was pointed out by Małkiewicz et al. [17]. The diet of most children (60%) from our own research has not changed during the pandemic. Unfortunately, in every fifth family, due to the temporary confinement at home, the diet has deteriorated. Although most of the surveyed children did not change their dietary behavior, it should be recalled that monitoring studies [3] show that the dietary habits of Polish children are not satisfactory, and the diet of young Poles is rich in sugar. The pandemic has kept it that way. The only hope is that some parents

(19.4%) began to pay more attention to the quality of nutrition in this period. On the other hand, the deterioration of dietary behavior during the pandemic was observed by researchers from Spain and Portugal. During the pandemic, 41.2% of the children in these studies ate 2 snacks between meals. Every fifth child (21.3%) ate as many as 3 snacks a day [18]. For comparison, our own research shows that sweet snacks were consumed by most children (44.7%) several times a week. Every tenth child ate sweets several times a day.

Oral hygiene is a key element in the prevention of caries, to which school-aged children are particularly exposed [3, 4]. Stein et al. observed a positive impact of the pandemic period on oral hygiene in only 1/5 of the respondents [19]. And the research by Goswami et al. shows that the general attitude and practices of parents regarding oral health during the pandemic were unsatisfactory [20]. As many as 60.8% of parents reported the need for dental treatment of their child during the lockdown period, but only 33.3% of carers made additional efforts to maintain their child's oral hygiene, and 45% introduced nutritional changes in the child's diet to prevent caries. Hygiene procedures of 2/3 of the children from own research did not change during the pandemic. It should be noted, however, that the hygienic habits of Polish children are not sufficient, as reported by the results of monitoring studies. Every second 3-year-old and every third 6-year-old did not brush their teeth twice a day [3]. In our research, it was noted that 60% of children brushed their teeth twice a day, but this group included not only small children, but also older children and adolescents up to 18 years of age. It is not common among young Poles to use dental floss and additional oral hygiene products, which was also confirmed by the results of our research – 71.2% of children did not use either floss or mouthwash, but only toothpaste.

The surveyed parents were divided with regard to the beneficial effects of fluoride. Some of them used fluoride-free toothpaste for fear of its negative effects, despite the fact that scientific research clearly proves its beneficial effect on maintaining oral health [4, 21, 22]. The exogenous supply of this element is especially important, among others, in toothpastes. Easy access to information on the Internet has increased parents' awareness of the use of fluoride preparations and its mode of action and impact on children's teeth. The study shows that the main source from which parents obtained information about fluoride was the Internet (67%), followed by a dentist (38%). Various Internet sources can convincingly present inaccurate and often downright false information that spreads rapidly, weakening and/or discrediting the opinion of experts [23]. The lack of control over the content posted on the Internet, which may contradict scientific reports, should be a cause for concern. Parents need to be made aware of the credibility of the sources they rely on.

CONCLUSIONS

Knowledge about the SARS-CoV-2 is ambiguous. Despite concerns about COVID-19, the parents of most children did not change their children's dietary and hygiene behavior and did not completely abandon treatment. Although 84.3% of the respondents felt safe coming to the dental office for visits, the frequency of these visits decreased. This fact may contribute

to the deterioration of oral health in the long term, and more research is needed on the impact of the pandemic on oral health.

REFERENCES

- Kochhar AS, Bhasin R, Kochhar GK, Dadlani H. COVID-19 pandemic and dental practice. *Int J Dent* 2020;2020:8894794.
- Faccini M, Ferruzzi F, Mori AA, Santin GC, Oliveira RC, Oliveira RC, et al. Dental care during COVID-19 outbreak: a web-based survey. *Eur J Dent* 2020;14(Suppl 1):S14-9.
- Ministerstwo Zdrowia. Monitorowanie stanu zdrowia jamy ustnej populacji polskiej na lata 2016–2020. Serwis Rzeczypospolitej Polskiej. <https://www.gov.pl/web/zdrowie/monitorowanie-stanu-zdrowia-jamy-ustnej-populacji-polskiej-w-latach-2016-2020> (9.01.2023).
- Olczak-Kowalczyk D, Szczepańska J, Kaczmarek U, editors. *Współczesna stomatologia wieku rozwojowego*. Otwock: Med Tour Press; 2017. p. 856.
- Lyu W, Wehby GL. Effects of the COVID-19 pandemic on children's oral health and oral health care use. *J Am Dent Assoc* 2022;153(8):787-96.e2.
- Sari A, Bilmez ZY. Effects of coronavirus (COVID-19) fear on oral health status. *Oral Health Prev Dent* 2021;19(1):411-23.
- Burgette JM, Weyant RJ, Ettinger AK, Miller E, Ray KN. What is the association between income loss during the COVID-19 pandemic and children's dental care? *J Am Dent Assoc* 2021;152(5):369-76.
- Goriuc A, Sandu D, Tatarciuc M, Luchian I. The impact of the COVID-19 pandemic on dentistry and dental education: a narrative review. *Int J Environ Res Public Health* 2022;19(5):2537.
- Campus G, Diaz Betancourt M, Cagetti MG, Giacaman RA, Manton DJ, Douglas G, et al. The COVID-19 pandemic and its global effects on dental practice. An International survey. *J Dent* 2021;114:103749.
- Sharma P, Dhawan P, Rajpal S, Bhat A. Knowledge, attitudes, and perception of parents toward dental treatment of children during the COVID-19 outbreak. *Int J Clin Pediatr Dent* 2021;14(5):693-9.
- Martina S, Amato A, Faccioni P, Iandolo A, Amato M, Rongo R. The perception of COVID-19 among Italian dental patients: an orthodontic point of view. *Prog Orthod* 2021;22(1):11.
- Luzzi V, Ierardo G, Bossù M, Polimeni A. Paediatric oral health during and after the COVID-19 pandemic. *Int J Paediatr Dent* 2021;31(1):20-6.
- Lamba G, Nagpal DI, Chowdhari P, Hotwani K, Gunwal MK. Oral healthcare management of children after COVID-19 outbreak. *Int J Clin Pediatr Dent* 2021;14(2):293-7.
- Peng X, Xu X, Li Y, Cheng L, Zhou X, Ren B. Transmission routes of 2019-nCoV and controls in dental practice. *Int J Oral Sci* 2020;12(1):9.
- Olszewska A, Paszynska E, Roszak M, Czajka-Jakubowska A. Management of the oral health of children during the COVID-19 pandemic in Poland. *Front Public Health* 2021;9:635081.
- Matsuyama Y, Isumi A, Doi S, Fujiwara T. Impacts of the COVID-19 pandemic exposure on child dental caries: difference-in-differences analysis. *Caries Res* 2022;56(5-6):546-54. doi: 10.1159/000528006.
- Małkiewicz EH, Borkowska T, Wierzbicka M. Świadomość stomatologiczna i zachowania zdrowotne opiekunów dzieci, zainteresowanych programami profilaktycznymi. *Probl Hig Epidemiol* 2012;93(1):90-6.
- Costa AL, Pereira JL, Franco L, Guinot F. COVID-19 lockdown: impact on oral health-related behaviors and practices of Portuguese and Spanish children. *Int J Environ Res Public Health* 2022;19(23):16004.
- Stein C, Santos NML, Hilgert JB, Hugo FN. Effectiveness of oral health education on oral hygiene and dental caries in schoolchildren: systematic review and meta-analysis. *Community Dent Oral Epidemiol* 2018;46(1):30-7.
- Goswami M, Grewal M, Garg A. Attitude and practices of parents toward their children's oral health care during COVID-19 pandemic. *J Indian Soc Pedod Prev Dent* 2021;39(1):22-8.
- Pollick H. The role of fluoride in the prevention of tooth decay. *Pediatr Clin North Am* 2018;65(5):923-40.
- Iracki J, Wierzbicka M. Skuteczność aktywnych składników past do zębów jako element stomatologii opartej na dowodach. *Czas Stomat* 2005;58(6):414-21.
- Burgette JM, Dahl ZT, Yi JS, Weyant RJ, McNeil DW, Foxman B, et al. Mothers' sources of child fluoride information and misinformation from social connections. *JAMA Netw Open* 2022;5(4):e226414.