

СТОМАТОЛОГІЯ ДИТЯЧОГО ВІКУ

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INDIRECT IMPACT OF SEASONAL FACTORS ON PEDIATRIC ORAL HEALTH

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Relevance

Seasonal factors exert a measurable influence on the onset and progression of numerous systemic diseases [1]. Variability in immune response across the calendar year has been proposed as one of the underlying mechanisms, with both cellular and humoral components demonstrating seasonal fluctuations. These changes are shaped not only by intrinsic regulatory pathways but also by behavioral determinants such as nutrition and physical activity [2].

Reduced ambient temperature and shortened photoperiod are associated with altered immune activity, including diminished lymphocyte function and reduced granulocyte phagocytic capacity [2]. Climatic conditions further modulate these responses: in tropical regions, the rainy season has been linked to decreased immune parameters in children, whereas in temperate climates winter is consistently associated with heightened susceptibility to respiratory infections [3]. Seasonal variation in melatonin secretion, driven by photoperiod changes, also contributes to circadian and immunological modulation [2].

Periodontitis is recognized as a chronic inflammatory disease, the course of which is determined by the interplay between microbial challenge and host immune response, further influenced by genetic predisposition and lifestyle factors such as smoking, diabetes, diet, stress, and physical activity [4]. Seasonal changes may therefore act as additional modulators of immune regulation. Viral infections, particularly influenza and other respiratory pathogens, demonstrate increased prevalence in winter, accompanied by systemic inflammatory shifts [5]. Given the central role of immune mechanisms in periodontal pathogenesis, such fluctuations may indirectly affect periodontal tissues [1].

Nasal breathing is fundamental for maintaining physiological airway function, craniofacial develop-

ment, and balanced oral microbiota. Impairment of nasal breathing often leads to mouth breathing, which alters salivary flow, reduces oral cavity humidity, and creates favorable conditions for pathogenic microorganisms. Previous studies have demonstrated associations between mouth breathing and increased prevalence of dental caries, gingivitis, and malocclusion. However, the indirect seasonal impact on oral health mediated by nasal breathing impairment remains insufficiently investigated.

One plausible mechanism is the development of xerostomia, which reduces local immune defense. Mouth breathing, whether of organic or functional origin, demonstrates seasonal variability and may exacerbate oral dysbiosis. Thus, although numerous studies have addressed the impact of mouth breathing on oral health, the role of seasonal factors in shaping these changes remains insufficiently explored.

The aim of this study was to investigate the indirect impact of seasonal factors on pediatric oral health, focusing on nasal breathing impairment as a mediating mechanism. We hypothesized that winter months are associated with higher prevalence of impaired nasal breathing, which in turn increases the burden of dental caries, periodontal disease.

Materials and methods of research

Study design and population

This cross-sectional study was conducted at the Educational and Scientific Medical Center "University Clinic" of Zaporizhzhia State Medical and Pharmaceutical University and at the Department of Therapeutic, Orthopedic and Pediatric Dentistry, Zaporizhzhia State Medical and Pharmaceutical University, Zaporizhzhia, Ukraine.

A total of 112 children aged 8–17 years were examined between 2019 and 2025 during routine dental visits. The median age was 12 years (range 7–17), with 58 girls (51.8%) and 54 boys (48.2%).

Inclusion criteria: age between 8 and 17 years; presence or absence of nasal breathing impairment according to grouping criteria; absence of acute systemic diseases at the time of examination; at least 20 teeth present in the oral cavity; no antibacterial therapy within the last 3–4 weeks; written informed consent obtained from parents or legal guardians.

Exclusion criteria: chronic diseases affecting the endocrine system; acute respiratory diseases or clinically significant acute ENT pathology at the time of examination; previous orthodontic treatment; congenital craniofacial anomalies; use of antibiotics, corticosteroids, or probiotics within the previous 3–4 weeks; inability to undergo a complete examination; refusal to participate in the study.

The etiology of impaired nasal breathing was not the subject of the present study. The main group included children with persistent impaired nasal breathing confirmed clinically and by anterior active rhinomanometry, in the absence of acute respiratory diseases and clinically significant acute ENT pathology. Thus, in most cases, impaired nasal breathing was functional or anatomical in nature and was not associated with acute inflammatory processes. Specific diagnostic assessment of the etiological causes of impaired nasal breathing was not performed within the study protocol, as this was beyond the aim of the study.

Otolaryngological examination and rhinomanometry

All otolaryngological examinations were performed by the same specialist to ensure consistency. Nasal airflow was assessed using anterior active rhinomanometry with the HRR device (Version 3.5; RhinoLab GmbH, Germany). The threshold criterion for impaired nasal breathing was defined as a total volumetric nasal airflow <500 ml/s at a pressure gradient of 150 Pa. Values ≥500 ml/s were classified as physiological nasal breathing [6].

Grouping of participants

Children were divided into two groups based on nasal breathing function: Group I (n = 49): impaired nasal breathing (mouth breathing of varying severity); Group II (n = 63): physiological nasal breathing (Table 1).

Dental examination

Dental status was evaluated under standardized conditions using artificial lighting. Caries intensity was assessed using DMFS/dmfs indices. The DMFS/dmfs index was determined by recording the number of decayed, missing due to caries, and filled tooth surfaces according to the standard methodology recommended by the World Health Organization. Five surfaces were assessed for posterior teeth, whereas four surfaces were assessed for incisors and canine.

Periodontal health was evaluated by probing pocket depth (PPD, mm), bleeding on probing (BOP, %). Screening of periodontal status was performed using the Community Periodontal Index (CPI) [7].

Orthodontic anomalies were recorded according to Angle's classification (open bite, deep bite,

crossbite, maxillary constriction). The Index of Orthodontic Treatment Need (IOTN) was applied for quantitative assessment.

Microbiological analysis

Samples of dental plaque and periodontal pockets were collected using sterile paper points. Quantitative determination of microorganisms was performed by real-time polymerase chain reaction (qPCR) at the university laboratory. The following microorganisms were analyzed: *Streptococcus mutans*, *Lactobacillus spp.*, *Porphyromonas gingivalis*, *Tannerella forsythia*, and *Treponema denticola*. Results were expressed as log₁₀ DNA copies/ml.

The study material consisted of dental plaque and gingival crevicular contents. Biological samples were collected from teeth exhibiting the most pronounced clinical signs of gingival inflammation, including gingival hyperemia, edema, and bleeding on probing. Before sample collection, the operative field was isolated with cotton rolls. The tooth surface was cleaned of supragingival plaque, disinfected with 70% ethanol, and dried using sterile cotton pellets.

Samples were collected using sterile paper points (ISO size 30), which were gently inserted into the gingival sulcus until slight resistance was felt and left in place for 15 s. Four paper points obtained from the sites with the most pronounced inflammatory changes were pooled into a single sterile 1.5-mL microcentrifuge tube to obtain one representative sample for each participant. The specimens were transported to the molecular biology laboratory at 2–8 °C and processed according to the manufacturer's instructions for the molecular assay.

Seasonal factor assessment

Examinations were conducted across all calendar seasons. Season of examination was considered a potential confounding factor. To minimize bias, children with acute respiratory conditions were excluded. Nasal breathing impairment was treated as a functional exposure factor, independent of etiology.

Statistical analysis

Data analysis was performed using IBM SPSS Statistics and Statistica software. Normality of distribution was tested with the Shapiro–Wilk test. Due to non-normal distribution, results were presented as median (Me) and interquartile range (Q1; Q3). Mann–Whitney U test was applied for comparison of two independent groups; Kruskal–Wallis test for comparison of more than two groups; Pearson's χ^2 test or Fisher's exact test for categorical variables. Differences were considered statistically significant at $p < 0.05$.

The study was not designed to establish a clinical diagnosis of periodontal disease or to classify participants according to specific periodontal disease entities. Instead, periodontal tissue status was assessed using standardized clinical periodontal indices.

Research results and discussion

General findings

The distribution of examined children across seasons differed significantly between the impaired

nasal breathing group (Group I) and the physiological breathing group (Group II) ($p = 0.02$). Specifically, Group I demonstrated a higher proportion of

examinations during winter, whereas Group II was predominantly examined in summer (tabl. 1).

Table 1.
Sociodemographic and seasonal characteristics of examined children according to nasal breathing status

Variable	Category	Group I (Impaired nasal breathing)	Group II (Physiological nasal breathing)	p-value
Age	Me [Q1; Q3]	11 [7; 16]	13 [8; 17]	–
Sex	Boys	29 (59,2 %)	34 (54,0 %)	0,77
	Girls	20 (40,8 %)	29 (46,0 %)	
Residence	Urban	32 (65,3 %)	32 (50,8 %)	<0,001
	Rural	17 (34,7 %)	31 (20,6 %)	
Season of examination	Winter	18 (36,7 %)	13 (20,6 %)	0,02
	Summer	17 (34,7 %)	29 (46,0 %)	
	Autumn	11 (22,4 %)	10 (15,9 %)	
	Spring	3 (6,2 %)	11 (17,5 %)	

Note: Data are presented as n (%); p values indicate comparisons between Group I and Group II (χ^2 test or Fisher's exact test for categorical variables; Mann–Whitney U test for continuous variables). Differences were considered statistically significant at $p < 0.05$.

Based on Table 1, the seasonality coefficient (K) was calculated as 3.29 ($K = \max/\min$; $K = 41.1/12.5 \approx 3.29$), indicating moderately expressed seasonal variability in the distribution of examined children. The results confirm an uneven distribution of patients across seasons, with the highest proportion observed in summer (41.1%) and the lowest in spring (12.5%).

The study was temporarily suspended between February 2022 and September 2023. During 2019–

2022, 64.3% ($n = 72$) of the total sample was examined, with 29.2% ($n = 21$) residing in rural areas and 70.8% ($n = 51$) in urban areas. In contrast, during 2023–2025, among 40 examined children, the proportion of rural residents was significantly higher at 67.5% ($n = 27$).

No statistically significant difference in seasonal distribution was observed between the periods 2019–2022 and 2023–2025 ($\chi^2 = 1.84$, $p = 0.607$) (Table 2).

Table 2.
Distribution of examined children according to study period

Variable	Category	2019–2022 ($n = 72$)	2023–2025 ($n = 40$)	p-value
Season of examination	Winter	18 (25,0 %)	13 (32,3 %)	0,60
	Summer	30 (41,7 %)	16 (40,0 %)	
	Autumn	13 (18,0 %)	8 (20,0 %)	
	Spring	11 (15,3 %)	3 (7,5 %)	
Sex	Boys	34 (47,2 %)	20 (50,0 %)	0,77
	Girls	38 (52,8 %)	20 (50,0 %)	
Residence	Urban	51 (70,8 %)	13 (32,5 %)	<0,001
	Rural	21 (29,2 %)	27 (67,5 %)	

Note: Data are presented as n (%). p values indicate comparisons between study periods (χ^2 test or Fisher's exact test for categorical variables).

No statistically significant differences in sample distribution were observed across individual seasons: p (winter) = 0.395, p (summer) = 0.864, p (autumn) = 0.801, p (spring) = 0.233. Likewise, no significant difference was found by sex ($\chi^2 = 0.08$, $p = 0.778$).

A statistically significant difference in place of residence was observed between the study periods: in 2023–2025, the proportion of children from rural areas was significantly higher ($\chi^2 = 15.43$, $p < 0.001$, Fisher's exact test; $p = 0.00013$).

Impaired nasal breathing was more prevalent in winter (RR=1.52, OR=2.23, $p < 0.05$).

Caries and periodontal health

Children with impaired nasal breathing had significantly higher caries intensity (DMFS/dmfs: 6.0 vs. 3.8, $p < 0.01$). The probing pocket depth (PPD) did

not differ significantly between the two groups: in children with impaired nasal breathing, PPD was 2.5 [2.1–2.8] mm, whereas in those with physiological nasal breathing it was 2.4 [2.0–2.6] mm ($p > 0.05$).

However, the enhanced inflammatory activity in periodontal tissues among Group I children was reflected in a higher bleeding on probing (BOP) index: 49.0 [44.0–53.0]% compared to 29.0 [25.0–33.0]% in Group II ($p < 0.01$).

The severity of periodontal inflammation in Group I was also confirmed by elevated Community Periodontal Index (CPI) scores: 2 [1–3] points versus 1 [0–2] points in Group II ($p < 0.01$).

Microbiological analysis

Quantitative PCR revealed elevated levels of cariogenic and periodontal pathogens in mouth-breathing children. *Streptococcus mutans* and *Lac-*

tobacillus spp. increased by 0.9 $\log_{10}$, while *Porphyromonas gingivalis*, *Tannerella forsythia*, and *Treponema denticola* increased by 1.2 $\log_{10}$ ($p < 0.001$) (Fig. 1)

The contamination of *Porphyromonas gingivalis* in periodontal pockets among Group I children reached a median of 6.5 [5.8–6.9], compared to 5.4 [4.9–5.8] in Group II ($p < 0.001$). Elevated concentrations in Group I compared to Group II were con-

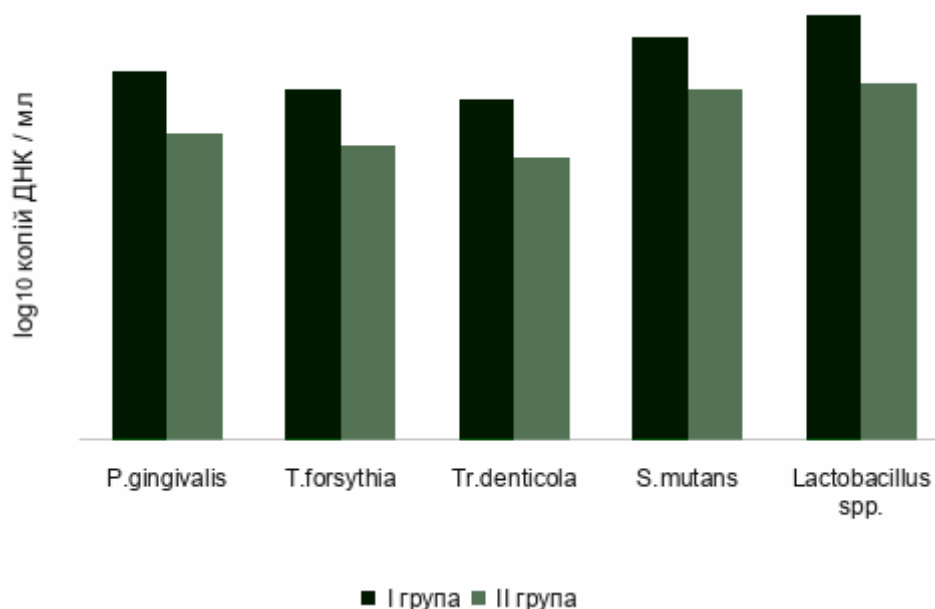
sistently observed across all pathogens:

Tannerella forsythia – 6.2 [5.6–6.6] vs. 5.2 [4.8–5.6] ($p < 0.001$);

Treponema denticola – 6.0 [5.4–6.5] vs. 5.0 [4.6–5.4] ($p < 0.001$);

Streptococcus mutans – 7.1 [6.5–7.6] vs. 6.2 [5.7–6.7] ($p < 0.001$);

Lactobacillus spp. – 7.5 [6.8–8.0] vs. 6.3 [5.8–6.9] ($p < 0.001$).



Note: Data are presented as median and interquartile range (Me [Q1–Q3]).

Figure 1. Concentrations of microorganisms ($\log_{10}$ DNA copies/ml) in children according to nasal breathing status.

These findings confirm a significantly higher pathogenic microbial burden in children with impaired nasal breathing, supporting the hypothesis of functional respiratory disturbances as a contributing factor to oral dysbiosis and periodontal inflammation.

An increase in the concentrations of all investigated microorganisms was observed: *Porphyromonas gingivalis* by 1.1 $\log_{10}$ ($p < 0.001$), *Tannerella forsythia* by 1.0 $\log_{10}$ ($p < 0.001$), *Treponema denticola* by 1.0 $\log_{10}$ ($p < 0.001$), *Streptococcus mutans* by 0.9 $\log_{10}$ ($p < 0.001$), and *Lactobacillus* spp. by 1.2 $\log_{10}$ ($p < 0.001$).

These findings demonstrate a consistent and statistically significant elevation in pathogenic microbial load among children with impaired nasal breathing compared to those with physiological nasal respiration.

Craniofacial morphology

Cephalometric evaluation confirmed vertical growth patterns and malocclusion in children with impaired nasal breathing. Angle Class II malocclusion was more frequent in this group.

Analysis of seasonal influence on nasal breathing and dental pathology

According to Table 1, 31 children were examined during the winter season: impaired nasal breathing was identified in 36.7% ($n = 18$), while 20.6% ($n = 13$) demonstrated physiological nasal breathing. Within Group I (children with impaired

nasal breathing), the proportion of winter examinations ($n = 18$; 36.7%) was higher compared to other seasons: summer – 17 (34.7%), autumn – 11 (22.4%), spring – 3 (6.2%).

Analysis of the distribution of 112 examined children across seasons between Group I and Group II revealed statistically significant differences ($\chi^2 = 9.6$; $df = 3$; $p = 0.02$). In winter, the proportion of children with impaired nasal breathing was higher compared to other seasons (58.1% vs. 38.3%). The relative risk (RR) of detecting impaired nasal breathing in winter was 1.52, and the odds ratio (OR) was 2.23. These findings indicate a statistically significant association between the winter season and an increased likelihood of impaired nasal breathing.

Impaired nasal breathing was associated with a statistically significant deterioration in dental status, manifested by higher caries intensity, increased signs of periodontal inflammation, and elevated microbial load. Thus, impaired nasal breathing should be considered an independent functional risk factor for the development of dental pathology in children.

A statistically significant seasonal variability in the frequency of impaired nasal breathing was established ($p = 0.02$), with a higher probability of detection during the winter period (RR = 1.52). The seasonal factor exerts an indirect influence on children's oral health through changes in the frequency of impaired nasal breathing.

The obtained results substantiate the importance of considering nasal breathing function and seasonal factors in the prevention and management of dental diseases in pediatric populations.

The highest burden of oral disease was observed in winter, with reduced prevalence in spring and summer. Seasonal variation was consistent across caries, periodontal indices, and microbial composition.

Discussion

The aim of this study was not to determine the etiology of impaired nasal breathing or to compare specific ENT disorders. Rather, the study focused on the functional status of nasal breathing, as assessed by clinical examination and active anterior rhinomanometry. Despite statistically significant differences in seasonal distribution, impaired nasal breathing in this study was considered an integral functional indicator, confirmed both clinically and instrumentally. The causes of its occurrence (seasonal or chronic) were not analyzed. Accordingly, dental status was assessed under conditions of already established impaired nasal breathing, allowing interpretation of the results as characteristics of this condition regardless of etiology.

The study demonstrated that impaired nasal breathing may act as an independent factor influencing children's oral health. In patients with oral breathing, a statistically significant increase in caries intensity (DMFS/dmfs), periodontal inflammation indices (BOP, CPI), and microbial load was observed. These findings are consistent with contemporary studies showing that oral breathing is associated with increased risk of caries and gingivitis due to disruption of mucosal physiology and salivary defense mechanisms [8,9].

The study was based on the hypothesis that impaired nasal breathing represents an intermediate functional mechanism through which seasonal factors may influence children's oral health. Therefore, the presence of impaired nasal breathing itself, rather than its underlying cause, was considered the primary exposure of interest. This approach is consistent with current evidence indicating that the adverse effects on oral health are primarily associated with mouth breathing itself, regardless of whether it is caused by allergic rhinitis, adenoid hypertrophy, nasal septal deviation, or other conditions [10].

The underlying mechanisms, including oral dryness, altered salivary function, oral dysbiosis, and an increased risk of dental caries and periodontal inflammation, are considered common to different etiologies of impaired nasal breathing [11].

The observed increase in concentrations of cariogenic (*S. mutans*, *Lactobacillus spp.*) and periodontopathogenic microorganisms (*P. gingivalis*, *T. forsythia*, *T. denticola*) aligns with microbiological data highlighting the role of oral breathing in promoting oral dysbiosis [12,13]. Mechanistically, oral breathing facilitates colonization of anaerobic and acid-producing flora through reduced salivary flow and altered pH balance.

Oral breathing is also recognized as a key factor in the development of hyperdivergent facial skeletal patterns and dentoalveolar anomalies [13, 14]. The morphological changes identified in children with impaired nasal breathing (increased FMA angle, vertical facial growth, posterior mandibular rotation) were expected outcomes.

An important result of this study is the demonstration of the indirect influence of seasonality on children's oral health through impaired nasal breathing. Similar trends have been described in studies of seasonal changes in upper airway function, showing increased frequency of nasal breathing disturbances during cold periods due to respiratory infections, dry air, and altered mucosal reactivity [14].

Conclusions

This study demonstrates that seasonal factors indirectly influence pediatric oral health through nasal breathing impairment. Winter months were associated with a higher prevalence of mouth breathing, which correlated with increased caries intensity, periodontal inflammation, and craniofacial alterations. Microbiological analysis confirmed elevated levels of cariogenic and periodontal pathogens in mouth-breathing children, while cephalometric evaluation revealed vertical growth patterns and malocclusion. These findings emphasize the importance of considering seasonal variability in pediatric dentistry and highlight the need for preventive measures, interdisciplinary collaboration, and early intervention to reduce the burden of oral disease and developmental anomalies in children.

Directions for future research

The study was limited by sample size and geographic scope. Future multicenter and longitudinal studies are needed to confirm seasonal patterns and evaluate long-term outcomes. Despite these limitations, the results provide strong evidence that seasonal factors indirectly affect pediatric oral health via nasal breathing impairment.

Further research will investigate the impact of the degree of nasal breathing impairment on children's oral health (microbiota, periodontal indices, caries index, and local/systemic immunity).

Authors' contribution

The authors acknowledge their contribution to the work as follows: idea, organization, planning of the research; writing and approval of the article - Varzhapetin S.D.; conducting research, recording and analyzing results - Kokar O.O.; conducting research, statistical analysis, writing an article - Dats,V.V.; conducting research (orthodontics), recording and analyzing results - Sydor O.V.

All authors reviewed the results and approved the final version of the manuscript.

Ethical statement

This study was conducted in accordance with the principles of the Declaration of Helsinki (2013 revision). The research protocol was reviewed and approved by the Institutional Ethics Committee of [на-

зва установи]. Written informed consent was obtained from all participants and their parents or legal guardians prior to inclusion in the study. All procedures involving human participants were performed with strict adherence to ethical standards, ensuring confidentiality and voluntary participation [15].

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Conflict of interest

The authors declare that they have no conflict of interest related to this study. All data collection, analysis, and interpretation were performed independently, without any financial or personal relationships that could influence the results.

Use of artificial intelligence

The authors also acknowledge the use of artificial intelligence tools (Microsoft Copilot) for language editing and translation support. All scientific content, data analysis, and conclusions were prepared and verified by the authors.

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Abstract

Objective. To investigate the indirect impact of seasonal factors on pediatric oral health, focusing on the role of nasal breathing impairment as a mediating mechanism. **Materials and methods.** A total of 112 children aged 8–17 years were examined across all four seasons. Participants were divided into two groups: those with impaired nasal breathing (n=49) and those with physiological nasal breathing (n=63). Clinical

evaluation included caries intensity (DMFS/dmfs), periodontal indices (PPD, BOP, CPI), orthodontic anomalies, and craniofacial morphology. Microbiological analysis of dental plaque and periodontal pockets was performed using qPCR for *Streptococcus mutans*, *Lactobacillus* spp., *Porphyromonas gingivalis*, *Tannerella forsythia*, and *Treponema denticola*. Statistical analysis assessed seasonal variability and group differences. **Results.** Seasonal variability was significant, with higher prevalence of nasal breathing impairment in winter (RR=1.52, OR=2.23, $p<0.05$). Children with impaired nasal breathing showed increased caries intensity (DMFS/dmfs: 6.0 vs. 3.8, $p<0.01$), higher bleeding on probing (49% vs. 29%, $p<0.01$), and elevated CPI scores (2 vs. 1, $p<0.01$). Microbiological analysis revealed significantly higher concentrations of cariogenic and periodontal pathogens in mouth-breathing children (increase of 0.9–1.2 log₁₀, $p<0.001$). Morphological evaluation confirmed craniofacial alterations consistent with vertical growth patterns. **Conclusions.** Seasonal factors indirectly affect pediatric oral health by influencing nasal breathing. Impaired nasal breathing is associated with increased oral disease burden and craniofacial changes, particularly during winter months. A study is planned to investigate the impact of the degree of nasal breathing impairment on children's oral health (microbiota, periodontal indices, caries index, and local/systemic immunity).

Key words: nasal breathing disorders, seasonal fluctuations; dental caries; periodontal diseases; craniofacial anomalies, occlusion.

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НЕПРЯМИЙ ВПЛИВ СЕЗОННИХ ФАКТОРІВ НА ЗДОРОВ'Я ПОРОЖНИНИ РОТА ДІТЕЙ

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Резюме

Мета. Дослідити непрямий вплив сезонних факторів на здоров'я порожнини рота дітей, зосереджуючись на ролі порушення носового дихання як посередницького механізму. **Матеріали і методи.** Роботу виконано на базі Навчально-наукового медичного центру Запорізького державного медико-фармацевтичного університету «Університетська клініка», на кафедрі терапевтичної, ортопедичної та дитячої стоматології Запорізького державного медико-фармацевтичного університету. Загалом було обстежено 112 дітей віком 8–17 років протягом усіх чотирьох сезонів. Учасників розділили на дві групи: ті, хто мав порушення носового дихання ($n=49$) і ті, хто мав фізіологічне носове дихання ($n=63$). Клінічна оцінка включала інтенсивність карієсу (DMFS/dmfs), пародонтальні індекси (PPD, BOP, CPI), ортодонтичні аномалії та краніофациальну морфологію. Мікробіологічний аналіз зубного нальоту і пародонтальних кишень проводили методом qPCR на штами: *Streptococcus mutans*, *Lactobacillus* spp., *Porphyromonas gingivalis*, *Tannerella forsythia* і *Treponema denticola*. Статистичний аналіз оцінював сезонну мінливість і групові розбіжності. **Результати.** Сезонна мінливість була значною, із вищою поширеністю порушення носового дихання взимку (RR=1,52, OR=2,23, $p<0,05$). У дітей із порушенням носового дихання спостерігалася підвищена інтенсивність карієсу (DMFS/dmfs: 6,0 проти 3,8, $p<0,01$), вища кровоточивість при зондуванні (49% проти 29%, $p<0,01$) і підвищені показники CPI (2 проти 1, $p<0,01$). Мікробіологічний аналіз виявив значно вищі концентрації карієсогенних і пародонтальних патогенів у дітей, які дихають ротом (збільшення на 0,9–1,2 log₁₀, $p<0,001$). Морфологічна оцінка підтвердила краніофациальні зміни, що відповідають вертикальним моделям росту. **Висновки.** Сезонні фактори опосередковано впливають на здоров'я порожнини рота дітей, впливаючи на носове дихання. Порушення носового дихання пов'язане зі збільшенням кількості захворювань порожнини рота і краніофациальними змінами, особливо в зимові місяці. Планується дослідження для вивчення впливу ступеня порушення носового дихання на здоров'я порожнини рота дітей (мікробіота, пародонтальні індекси, індекс карієсу і місцевий/системний імунітет).

Ключові слова: порушення носового дихання, сезонні коливання; карієс зубів; пародонтальні захворювання; черепно-лицеві аномалії, прикус.

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