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T.M. Volosovets[1], I.G. Dikova[2], O.V. Mozyrska[2], N.A. Slyusar[2]
[1]Shupyk National Healthcare University of Ukraine, Kyiv, Ukraine
[2]Bogomolets National Medical University, Kyiv, Ukraine

Prevalence of dental caries in pediatric patients with atopic dermatitis

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Abstract. ***Background.*** *Children with atopic dermatitis may be at increased risk of developing dental caries. This problem is poorly understood and needs attention. The aim of this study was to investigate the oral health status of children and adolescents with atopic dermatitis.* ***Materials and methods.*** *One hundred children with atopic dermatitis aged 2 to 17 years, median of 6 [3.5; 10], and 103 children without atopic dermatitis, median age 7 [5; 12.5] years, were included in the study. Clinical parameters included age, sex, age of onset and severity of atopic dermatitis according to the SCORing AD index (SCORAD). Patients with at least one type of caries at any stage of progression (from white spots to carious lesions with pulpal damage) were included in the caries group. The risk of caries in the atopic dermatitis group and in healthy children, and the significance of the presence of asthma and allergic rhinitis for the development of caries were evaluated using the odds ratio (OR) with a 95% confidence interval (CI). Results were considered statistically significant at the $p < 0.05$ level.* ***Results.*** *Caries was detected in 46 % of children with atopic dermatitis and 22 % controls (OR = 2.9630, CI 1.6131–5.4424, p = 0.0005). In the group of allergic rhinitis, 24 patients were found to have caries, and among those without allergic rhinitis, 22 children had caries. It was found that patients with concomitant allergic rhinitis were significantly more likely to develop caries (OR = 3.4406, CI 1.4693–8.0563, p = 0.0044). No such significance was found depending on the presence of asthma (OR = 1.3986, CI 0.4913–3.9814, p = 0.5).* ***Conclusions.*** *Children with atopic dermatitis have a significantly higher risk of dental caries than healthy children. Based on the results of our study, clinicians should be aware of dental manifestations in patients with atopic dermatitis and recommend regular dental examinations for early caries detection.*

Keywords: *atopic dermatitis; caries; children*

Introduction

Atopic dermatitis (AD) has become a serious medical and social problem because of its high prevalence, early onset and resistance to therapy, which adversely affect the physical and mental development of children and, in some cases, lead to disability and reduced quality of life for their families [1, 2].

Currently, there is a steady increase in the incidence of AD, which is associated with: early cessation of breastfeeding, irrational nutrition of children, especially in war-displaced populations, exposure to chemicals and adverse effects of the environment [3–6]. The aetiology and pathogenesis of AD in children are multifactorial. In addition to hereditary factors, food allergies, disturbed immune reactivity, disorders of neuroendocrine regulation, metabolism and microcirculation, the presence of worm infestations and foci of chronic infection (caries, stomatitis, tonsillitis) are of significant importance [1, 7, 8].

Perugia C. et al. (2017) indicate a higher prevalence of AD in children who were patients of dental clinics compared to the general population, suggesting that dental diseases may be a component in the pathogenesis of AD and vice versa [8, 9]. For example, the results of a longitudinal study by Kalhan T.A. and co-authors (2017) demonstrated that children with AD have an increased risk of caries development up to the age of 3 years, which may have a common basis in ectodermal defects in the process of tissue development (structural defect hypothesis) [9].

Для кореспонденції: Мозирська Олена Вікторівна, доцент кафедри педіатрії № 2 Національного медичного університету імені О.О. Богомольця, вул. Алішера Навої, 3, м. Київ, 02125, Україна; тел. +38067 901 81 08; e-mail: elenmoz85@gmail.com
For correspondence: Mozyrska Olena, Associate Professor at the Department of Pediatrics 2, Bogomolets National Medical University, Navoi st., 3, Kyiv, 02125, Ukraine; tel. +38067 901 81 08; e-mail: elenmoz85@gmail.com
Full list of authors' information is available at the end of the article.

Mouth breathing is not only known to be associated with such atopic diseases, including allergic rhinitis (AR) and asthma bronchiale (AS), but is also recognised as one of the common features in patients with AD [10–12]. Breathing through the mouth alters the protective mechanisms of the tissues of the oral cavity, as the oral mucosa is exposed to air during breathing, leading to an increased risk of disease, including the hard tissues of the teeth [13–15]. *S.mutans* was found to be highly prevalent in 70 % of mouth breathers and 43.3 % of controls, indicating a higher propensity for cariogenic activity [16].

As AD is a chronic, relapsing skin disease, most patients with moderate to severe AD are treated with systemic corticosteroids, immunomodulators and antihistamines. Long-term use of systemic corticosteroids is associated with opportunistic oral infections due to suppression of cellular immunity and phagocytosis. Javad et al. [17] confirmed that *Candida albicans* was isolated from the oral cavity of 23 % of patients with AD and 6 % of healthy controls ($p < 0.05$). Antihistamines cause decreased salivation and xerostomia due to their antimuscarinic effects. As salivary secretion plays an important role in caries prevention, antihistamines, which are commonly used in AD, are also considered to be cariogenic drugs [18].

The purpose of this work is to investigate the oral health status of children and adolescents with atopic dermatitis.

Materials and methods

Patients with AD (n = 100), aged 2–17 years, median 6 years [3.5; 10], from the Allergology Department of Kyiv City Children's Clinical Hospital 2 were included in the study. The control group consisted of 103 children without AD, median age 7 years [5; 12.5]. This study was approved by the Ethics Committee of the Bogomolets National Medical University (Protocol No. 2 dated October 21, 2020), all patients/parents of sick children gave informed consent to participate. The diagnosis of AD was made according to the criteria of Hanifin & Rajka.

Clinical parameters of the patients included age, sex, age of onset and severity of AD. The severity of AD was assessed using the SCORing index (SCORAD). Patients with at least one carious lesion (from white spots to a carious cavity with pulpal damage) were included in the group of children with carious lesions.

Inclusion criteria were age 2–17 years, duration of AD more than 1 year. Exclusion criteria were as follows: severe systemic disease or malignant neoplasm, mental disorder and impaired psychomotor development.

Statistical processing of the obtained data was performed with the statistical package IBM SPSS Statistics Base (version 22) and the software EZR version 1.32 (graphical interface of the R environment, version 2.13.0). Continuous variables were described as median [I quartile; III quartile], and qualitative variables were presented as frequencies and percentages [n (%)]. The risk of caries in the group with AD and in healthy children and the significance of the presence of BA and AR for the development of caries were estimated by the odds ratio (OR) with a 95% confidence interval (CI). The results were considered statistically significant at the $p < 0.05$ level.

Results

Dental health was assessed in 100 children with AD, aged 2 to 17 years, median age 6 [3.5; 10], and 103 children without AD, median age 7 [5; 12.5]. There were 56 boys (56 %) and 44 girls (44 %) among the patients, and 49 boys (47 %) and 54 girls (53 %) among the healthy children. The median disease duration in the patient group was 5 [3; 9] years. The median SCORAD severity index was 30 [28; 55] points. In this group of patients, 17 patients had BA and 37 patients had RA.

The following results were obtained: 46 (46 %) children with AD and 23 healthy children (22 %) had carious lesions. The difference was statistically significant (OR = 2.9630, CI 1.6131–5.4424, p = 0.0005). We compared the frequency of caries detection in children with concomitant allergic diseases — BA and RA — and those without. In the group of children with AR, caries was detected in 24 children, in the group of children without AR — in 22 children. It was found that children with concomitant AR had significantly more carious lesions (OR = 3.4406, CI 1.4693–8.0563, p = 0.0044). In the group of children with concomitant AR, caries was found in 9 children, and in the group without AR— in 37 children. No such significance was found depending on the presence of AD (OR = 1.3986, CI 0.4913–3.9814, p = 0.5).

Discussion

This study demonstrated that children with AD are prone to the occurrence and development of carious lesions (OR = 2.9630, CI 1.6131–5.4424, p = 0.0005). In addition, children with concomitant AR also have an increased risk of the occurrence and development of carious lesions (OR = 3.4406, CI 1.4693–8.0563, p = 0.0044). This may be due to the presence of genetic abnormalities of the epithelium and mouth breathing due to obstructed nasal breathing.

Among the multifactorial aetiologies of dental caries, some risk factors, particularly genetic ones, are considered to be common with AD-related factors. In a recent study, polymorphisms in the keratin hair and epithelium gene (KRT75) contributed to increased changes in enamel structure. A possible association between hair disorders and susceptibility to the onset and development of carious lesions has been demonstrated [19]. Similarly, barrier abnormalities in Alzheimer's disease, also caused by various genetic mutations, may play a role in caries pathogenesis [20]. The distal homeobox gene has been shown to play a critical role in both enamel formation and regulation of epidermal differentiation, and a polymorphism in the Toll-like receptor 2 gene has also been associated with both AD and dental caries [21]. The filaggrin gene, which is expressed in both skin and oral mucosa, also influences the pathogenesis of dental caries in AD patients [22]. Thus, the absence of filaggrin in the oral mucosa contributes to epidermal barrier dysfunction, leading to dryness and infections caused by *Streptococcus mutans*, *Streptococcus sobrinus* and *Lactobacilli* [9].

Diseases of the oral cavity, such as caries and gingivitis, can have a negative impact on people's quality of life, and in the case of AD, the poor condition of the oral cavity may hinder its treatment and worsen its clinical manifestations [23]. A study of Igawa et al. showed that adults with AD who

had focal odontogenic infections (30 %) had a significant improvement in skin manifestations after 3 months of dental treatment [23]. Furthermore, a longitudinal study of Kalhan et al. (2017) found an association between early childhood caries and AD. They observed that children with AD had a higher risk of carious lesions occurring and developing at the age of 3 years (35.8 %) [9]. The authors believe that the association between these conditions is due to ectodermal defects that occurred during tissue development, as both caries and AD are associated with defects in structural genes (TLR2). In this study, carious lesions were observed in 41.3 % of patients, with a higher frequency in the mild AD group (45.16 %) compared to the moderate AD (40 %) and severe AD (37.5 %) groups, although the difference was not statistically significant ($p > 0.05$) [10].

In the study of Stofella Sodré C., was presented information that the index of decayed, missing and filled teeth in the permanent dentition (DMFT) was significantly higher in patients with mild AD than in patients with moderate AD (0.59; SD ± 1.06 vs. 0.07; SD ± 0.25; $p = 0.011$) [7].

Scientific studies conducted with inclusion of patients with other atopic diseases, such as AD and RA, have shown conflicting results regarding the relationship between dental disease and manifestations of allergic disease in children and adolescents [14, 24]. A study of Shulman et al. discover that adolescents with severe AD with permanent teeth had lower DMFT and fewer carious lesions than systemically healthy controls, but the same relationship was not significant in children with primary dentition [25]. Hassanpour et al. (2019) have found a higher mean DMFT in patients with AD than in a healthy group ($p < 0.05$) [26]. This finding supports the results of the paper showing that patients with AD who used inhaled corticosteroids were 6.4 times (OR = 6.41, 95% CI 1.88–21.08, $p = 0.003$) more likely to have carious lesions than patients who did not use inhaled corticosteroids.

So in our opinion, with is supported by the results of previous studies, there is an association between AD and poor dental health in children. Children with AD form a risk group for the development of dental hard tissue disease and should be the focus of dental disease prevention efforts.

Conclusions

Children with atopic dermatitis have a significantly higher risk of carious lesions than healthy children. Based on the results of our study, clinicians should be aware of dental manifestations in patients with atopic dermatitis and recommend regular dental examinations for early detection of carious lesions and prevention of their complications. Further studies with a prospective longitudinal design and more accurate diagnostic systems are needed to test the direct role of atopic dermatitis in the onset and progression of dental hard tissue lesions.

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References

1. Okhotnikova OM, Yakovleva NYu. Atopic dermatitis in children: epidemiology, etiology, pathogenesis, clinic and diagnosis. Part 1. Medicines of Ukraine. 2018;(217):37-42. (in ukrainian). doi: 10.37987/1997-9894.2018.1(217).195374.

2. Silverberg JI. Public Health Burden and Epidemiology of Atopic Dermatitis. Dermatol Clin. 2017 Jul;35(3):283-289. doi: 10.1016/j.det.2017.02.002.

3. Volosovets OP, Beketova GV, Berezenko VS, et al. Allergic Rhinitis in Children of Ukraine: Transformation of Morbidity and Prevalence over the Past 24 Years. Pediatrics. Eastern Europe. 2021;9(3):347-356. doi: 10.34883/PI.2021.9.3.003. (in Russian).

4. Özçelik S, Kulaç İ, Yazıcı M, Öcal E. Distribution of childhood skin diseases according to age and gender, a single institution experience. Turk Pediatri Ars. 2018 Jun 1;53(2):105-112. doi: 10.5152/TurkPediatriArs.2018.6431.

5. Volosovets OP, Bolbot YuK, Beketova GV, et al. Allergic march in children of Ukraine. Medicni perspektivi. 2021;26(4):181-188. doi: 10.26641/2307-0404.2021.4.248227. (in Ukrainian).

6. Volosovets OP, Bolbot YuK, Beketova GV, et al. Allergic and non-allergic skin diseases in children of Ukraine: a retrospective study of the prevalence and incidence over the past 24 years. Medicni perspektivi. 2021;26(3):188-196. doi: 10.26641/2307-0404.2021.3.242265.

7. Stofella Sodré C, Ferreira DC, Vieira MS, et al. Clinical oral profile of pediatric patients with atopic dermatitis: A cross-sectional study. Oral Dis. 2021 Oct;27(7):1834-1846. doi: 10.1111/odi.13721.

8. Perugia C, Saraceno R, Ventura A, et al. Atopic dermatitis and dental manifestations. G Ital Dermatol Venereol. 2017 Apr;152(2):122-125. doi: 10.23736/S0392-0488.16.05224-X.

9. Kalhan TA, Loo EXL, Kalhan AC, et al. Atopic dermatitis and early childhood caries: Results of the GUSTO study. J Allergy Clin Immunol. 2017 Jun;139(6):2000-2003. doi: 10.1016/j.jaci.2016.10.038.

10. Yamaguchi H, Tada S, Nakanishi Y, et al. Association between Mouth Breathing and Atopic Dermatitis in Japanese Children 2-6 years Old: A Population-Based Cross-Sectional Study. PLoS One. 2015 Apr 27;10(4):e0125916. doi: 10.1371/journal.pone.0125916.

11. Izuhara Y, Matsumoto H, Nagasaki T, et al; Nagahama Study Group. Mouth breathing, another risk factor for asthma: the Nagahama Study. Allergy. 2016 Jul;71(7):1031-6. doi: 10.1111/all.12885.

12. Barros JR, Becker HM, Pinto JA. Evaluation of atopy among mouth-breathing pediatric patients referred for treatment to a tertiary care center. J Pediatr (Rio J). 2006 Nov-Dec;82(6):458-64. doi: 10.2223/JPED.1561.

13. Elad S, Heisler S, Shalit M. Saliva secretion in patients with allergic rhinitis. Int Arch Allergy Immunol. 2006;141(3):276-80. doi: 10.1159/000095297.

14. Wongkamhaeng K, Poachanukoon O, Koontongkaew S. Dental caries, cariogenic microorganisms and salivary properties of allergic rhinitis children. Int J Pediatr Otorhinolaryngol. 2014 May;78(5):860-5. doi: 10.1016/j.ijporl.2014.03.001.

15. Al-Awadi RN, Al-Casey M. Oral health status, salivary physical properties and salivary Mutans Streptococci among a group of mouth breathing patients in comparison to nose breathing. J Baghdad Coll Dent. 2013;25(Special Is):152-159.

16. Koga-Ito CY, Unterkircher CS, Watanabe H, Martins CA, Vidotto V, Jorge AO. Caries risk tests and salivary levels of immunoglobulins to Streptococcus mutans and Candida albicans in mouthbreathing syndrome patients. Caries Res. 2003 Jan-Feb;37(1):38-43. doi: 10.1159/000068225.

17. Javad G, Taheri Sarvtin M, Hedayati MT, Hajheydari Z, Yazdani J, Shokohi T. Evaluation of Candida Colonization and Specific Humoral Responses against Candida albicans in Patients with Atopic Dermatitis. Biomed Res Int. 2015;2015:849206. doi: 10.1155/2015/849206.

18. Scully C. Drug effects on salivary glands: dry mouth. Oral Dis. 2003 Jul;9(4):165-76. doi: 10.1034/j.1601-0825.2003.03967.x.

19. Duverger O, Ohara T, Shaffer JR, et al. Hair keratin mutations in tooth enamel increase dental decay risk. J Clin Invest. 2014 Dec;124(12):5219-24. doi: 10.1172/JCI78272.

20. Weidinger S, Novak N. Atopic dermatitis. Lancet. 2016 Mar 12;387(10023):1109-1122. doi: 10.1016/S0140-6736(15)00149-X.

21. Nibali L, Di Iorio A, Tu YK, Vieira AR. Host genetics role in the pathogenesis of periodontal disease and caries. J Clin Periodontol. 2017 Mar;44 Suppl 18:S52-S78. doi: 10.1111/jcpe.12639.

22. De Benedetto A, Qualia CM, Baroody FM, Beck LA. Filaggrin expression in oral, nasal, and esophageal mucosa. J Invest Dermatol. 2008 Jun;128(6):1594-7. doi: 10.1038/sj.jid.5701208.

23. Igawa K, Nishioka K, Yokozeki H. Odontogenic focal infection could be partly involved in the pathogenesis of atopic dermatitis as exacerbating factor. Int J Dermatol. 2007 Apr;46(4):376-9. doi: 10.1111/j.1365-4632.2007.03101.x.

24. Zahid W, Rozi S, Khan F, Zahid N, Kadir M. Association between Asthma and Dental Caries amongst 12 - 15 Years Old Children: A School-Based Cross-Sectional Study in Karachi, Pakistan. Open Journal of Epidemiology. 2019;9(1):104-117. doi: 10.4236/ojepi.2019.91010.

25. Shulman JD, Taylor SE, Nunn ME. The association between asthma and dental caries in children and adolescents: A population-based case-control study. Caries Res. 2001 Jul-Aug;35(4):240-6. doi: 10.1159/000047464.

26. Hassanpour K, Tehrani H, Goudarzian M, Beihaghi S, Ebrahimi M, Amiri P. Comparison of the frequency of dental caries in asthmatic children under treatment with inhaled corticosteroids and healthy children in Sabzevar in 2017-2018. Electron J Gen Med. 2019;16(2);em119. doi: 10.29333/ejgm/93478.

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Information about authors
T. Volosovets, PhD, DoMS, Professor of Department of Dentistry, Shupyk National Healthcare University of Ukraine; https://orcid.org/0000-0001-9950-3748; Scopus Author ID: 57215286301; ResearcherID: V-4878-2018
I. Dikova, PhD, Associate Professor at the Department of Theurapeutical Dentistry, Bogomolets National Medical University, Kyiv, Ukraine; https://orcid.org/0000-0001-8319-2068
O. Mozyrska, Associate Professor at the Department of Pediatrics 2, Bogomolets National Medical University, Kyiv, Ukraine; e-mail: elenmoz85@gmail.com; https://orcid.org/0000-0001-9936-8304
N. Slyusar, Assistant Professor at the Department of Pediatrics 2, Bogomolets National Medical University, Kyiv, Ukraine; https://orcid.org/0000-0002-7712-4461

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Волосовець Т.М.[1], Дікова І.Г.[2], Мозирська О.В.[2], Слюсар Н.А.[2]
[1]Національний університет охорони здоров'я України імені П.Л. Шупика, м. Київ, Україна
[2]Національний медичний університет імені О.О. Богомольця, м. Київ, Україна

Поширеність карієсу в педіатричних хворих на атопічний дерматит

Резюме. Актуальність. Діти з атопічним дерматитом можуть мати підвищений ризик розвитку карієсу. Ця проблема є маловивченою та потребує уваги. **Мета:** дослідити стан порожнини рота в дітей та підлітків з атопічним дерматитом. **Матеріали та методи.** У дослідження були включені 100 пацієнтів з атопічним дерматитом віком від 2 до 17 років, медіана 6 [3,5; 10], та 103 дитини без атопічного дерматиту, медіана віку 7 [5; 12,5] років. Клінічні параметри включали вік, стать, вік початку захворювання й тяжкість атопічного дерматиту за індексом SCORing AD (SCORAD). Пацієнти, які мали хоча б одне каріозне ураження (від білих плям до каріозної порожнини з ураженням пульпи), були включені до групи карієсу. Ризик виникнення карієсу при атопічному дерматиті та в здорових дітей, значення наявності бронхіальної астми і алергічного риніту щодо розвитку карієсу оцінювали за відношенням шансів (ВШ) із 95% довірчим інтервалом (ДІ). Результати вважалися статистично значущими на рівні $p < 0,05$. **Результати.** Карієс мали 46 % пацієнтів, хворих на атопічний дерматит, та 22 % дітей контрольної групи (ВШ = 2,9630, ДІ 1,6131–5,4424, $p = 0,0005$). У групі алергічного риніту 24 особи мали карієс, а в групі без алергічного риніту — 22. Було виявлено, що в дітей із супутнім алергічним ринітом карієс розвивався вірогідно частіше (ВШ = 3,4406, ДІ 1,4693–8,0563, $p = 0,0044$). Не було зареєстровано такої значимості залежно від наявності бронхіальної астми (ВШ = 1,3986, ДІ 0,4913–3,9814, $p = 0,5$). **Висновки.** Діти, хворі на атопічний дерматит, мають значно вищий ризик розвитку карієсу, ніж здорові. Виходячи з результатів нашого дослідження, лікарі повинні знати про стоматологічні прояви у хворих на атопічний дерматит і рекомендувати регулярні стоматологічні огляди для раннього виявлення карієсу.

Ключові слова: атопічний дерматит; карієс; діти