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THE ORAL HEALTH STATUS OF CHILDREN WITH CONGENITAL HEART DISEASE AND GREAT VASCULAR DEFECTS IN UKRAINE

Introduction. *Congenital heart disease (CHD) is one of the most common congenital defects worldwide. The increase in the number of patients with CHD creates a group of people with individual special care needs, including dental care.* ***Purpose.*** *To evaluate oral health conditions (oral hygiene, caries experience, periodontal health) in children with CHD and compare their caries experience with the one of the group of healthy children in Ukraine.* ***Materials and methods:*** *Fifty-eight children with congenital heart disease and eighty healthy children aged 3-15 years were enrolled in this study. According to their age and period of dentition, all the children were subdivided into 3 groups: with primary, mixed and permanent dentition. Caries experience, oral hygiene, periodontal health and dental developmental defects were assessed. A one-sample Kolmogorov–Smirnov test and an independent-measures t-Test were used. All statistical analyses were performed using the statistical software (SPSS version 26.0, SPSS Inc.). The statistical significance was set at 5%.* ***Results and discussion.*** *The caries experience of children with CHD and healthy children in primary dentition was 4.0 and 6.4 respectively. The highest DMFT was registered in children with CHD in mixed (4.7) and permanent (4.6) dentitions. 33,3% of children with primary dentition and up to 52,9% in mixed dentition had poor oral hygiene.* ***Conclusions.*** *According to limitation of this epidemiological study, there were no significant differences in caries experience of children with congenital heart disease and healthy children in primary and mixed dentitions. These findings indicate the importance of preventive dental care and appropriate treatment of children with CHD.*

Key words: *congenital heart disease, oral health, children, caries, airway volume, dentoalveolar abnormalities.*

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СТОМАТОЛОГІЧНИЙ СТАТУС ДІТЕЙ З ВРОДЖЕНИМИ ВАДАМИ СЕРЦЯ І МАГІСТРАЛЬНИХ СУДИН В УКРАЇНІ

Вступ. *Вроджені вади серця (ВВС) та магістральних судин є одними з найпоширеніших вроджених патологій у всьому світі. Збільшення кількості пацієнтів з ВВС створює групу людей з індивідуальними потребами в догляді, включаючи стоматологічну допомогу.* ***Мета.*** *Оцінити стоматологічний статус (рівень гігієни порожнини рота, інтенсивність карієсу, здоров'я тканин пародонту, поширеність аномалій прикусу, оцінити функціональні порушення зубощелепного апарату) у дітей з ВВС та порівняти інтенсивність карієсу зі здоровими дітьми в Україні.* ***Матеріали та методи.*** *У дослідженні взяли участь 58 дітей з вродженими вадами серця і магістральних судин та 80 здорових дітей віком від 3 до 15 років. Всі діти були розділені на 3 групи за віком і періодом прикусу: в тимчасовому, змінному та постійному прикусі. Оцінювали інтенсивність карієсу, рівень гігієни порожнини рота, стан тканин пародонту та дефекти розвитку зубів, аномалії прикусу, функціональні порушення зубощелепного апарату. Використовувався одновибірковий тест Колмогорова-Смирнова і t-критерій для незалежних зразків. Статистичний аналіз проводився за допомогою статистичного програмного забезпечення SPSS версії 26.0, SPSS Inc. Статистична значущість була встановлена на рівні 5%.* ***Результати та обговорення.*** *Інтенсивність карієсу в період тимчасової оклюзії у дітей з ВВС та здорових дітей становила 4,0 та 6,4 відповідно. Найбільша інтенсивність карієсу зафіксована у дітей з ВВС в період змінного (4,7) і постійного (4,6) періодів прикусу. У 33,3% дітей в тимчасовому періоді прикусу та до 52,9% дітей зі змінним періодом прикусу був незадовільний рівень гігієни порожнини рота.* ***Висновки.*** *Виходячи з обмежень даного епідеміологічного дослідження, істотних відмінностей в інтенсивності карієсу у дітей з вродженими вадами серця і здорових дітей в період тимчасової і змінної оклюзії не виявлено. Ці результати вказують на важливість профілактичної стоматологічної допомоги та належного лікування дітей з ВВС.*

Ключові слова: *вроджені вади серця, здоров'я порожнини рота, діти, карієс, об'єм дихальних шляхів, зубо-щелепні аномалії.*

Introduction. Congenital heart disease (CHD) is one of the most common congenital defect worldwide. The diagnostic and treatment options of congenital heart disease were dramatically improved over the last decades [1]. Consequently, significant decreasing of newborn and post-operative mortality, was registered. The last data demonstrate the increasing of CHD prevalence with average mean of 9.41 per 1000 children during 2010-2017 [2]. In Ukraine 4606 cases of CHD (12.87 per 1000 children) were registered among children less than 1 year old in 2017 [3]. Therefore, rising the number of patients with CHD creates the group of people with individual special care needs, including the dental care.

Congenital heart disease has the significant influence on the dental health and vice versa. First of all, it can increase the risk of infective endocarditis (IE) [4], also CHD creates a barrier for appropriate dental care and prevention [5]. As ameloblasts are very sensitive to metabolic changes during tooth development, that's why low weight, hypoxia, medicines etc. can effect on enamel formation [6]. Therefore, increasing of caries incidence can be recorded in children with CHD.

Children with CHD are in high risk of infective endocarditis [4, 7]. The incidence rate of IE in children with CHD varies 4.1-11.13 per 10 000 person-years [4, 8]. Oral bacteraemia Streptococcus mitis, Streptococcus mutans and Streptococcus sanguis are implicated in 20–40% of IE cases [9]. According to American Heart Association guidelines, IE is much more associated with bacteremia caused by oral daily activities like toothbrushing, flossing, chewing etc., than invasive dental procedures. Therefore, maintaining of oral hygiene and dental prophylaxis is mandatory for children with CHD for IE prevention [10]. Also, dental procedures preceded 11% of IE cases [11].

Professional dental care for children with sever chronic diseases like CHD is often neglected. It's associated with long-terms hospitalization and recovery period. A lot of children don't receive minimal preventive care. Also, parental attitude plays an important role in children's dental health. The few studies demonstrated that disease awareness and knowledge of parents about dental health were fair [12, 13]. Thus, a lot of parents didn't have enough information about risk of IE, importance of oral hygiene, adequate methods of dental prevention and link between CHD and oral health. Besides this, some dentists avoid treatment of this special group of patients due to systemic conditions. Consequently, untreated caries prevalence in this group increase, which can lead to cardiac surgery postponement or emergency dental treatment (including extraction) under general anesthesia.

Nevertheless, data about oral health in children with CHD, dental prevention and treatment, parents awareness is limited in Ukraine. **The aims of this pilot study were**: 1. to evaluate oral health conditions (oral hygiene, caries experience, periodontal health) in children with CHD; 2. to compare caries experience with group of healthy children.

Materials and methods. The study was carried out during the period October 2018 – December 2019 at the Department of Pediatric and Preventive Dentistry, Bogomolets National Medical University and Center for Pediatric Cardiology and Cardiac Surgery (Kyiv, Ukraine).

Study design and participants. Fifty-eight children aged 3-15 years old (mean age 9.35±4.86) with congenial heart disease were included in this study. In CHD group were presented children with Ebstein's anomaly, Tetralogy of Fallot, Aortic stenosis, Ventricular septal defect, Coarctation of the aorta, Transposition of the great arteries, Mitral atresia, etc. Children with other co-morbidities, like Down's syndrome, cerebral palsy, autistic specter disorders were excluded. All enrolled children were divided into three age groups: CHD1 – 18 participants with primary dentition (3-5 y.o.); CHD2 – 16 participants with mixed dentition (6-11 y.o.); CHD3 – 24 participants with permanent dentition (12-15 y.o.).

Also, eighty healthy children aged 3-15 y.o. (mean age 9.03±4.1) without congenital or acquired heart disease or other severe general disorders, who have visited the Department of Pediatric and Preventive Dentistry for the regular check-up, were included in the control group. Children who were uncooperated were excluded in both groups.

Clinical oral examinations. Dental examinations were conducted by two calibrated pediatric dentists with the probe and the dental mirror in the settings of the Department of Pediatric and Preventive Dentistry or Center for Pediatric Cardiology and Cardiac Surgery. Caries experience were assessed according to World Health Organization recommendations by dft/DMFT index. Also, the Significant Caries Index (SiC) was calculated in each group. pufa/PUFA index was used to assessing untreated dental caries. The oral hygiene of each child was measured by Visible Plaque Index (VPI). Basic periodontal examination (BPE) was used for periodontal health assessment. Codes 0, 1 and 2 were used for children with mixed dentition, aged 7-11 years.

Statistics. A one-sample Kolmogorov–Smirnov test was used to test the normality of distribution

Table

Caries experience in different groups, mean (SD)

	Children with CHD			Children without CHD		
	CHD-1 (n=18)	**CHD-2 (n=16)**	**CHD-3 (n=24)**	**1 (n=20)**	**2 (n=34)**	**3 (n=26)**
d	3.50 (3.9)	3.9 (2.9)	-	3.9 (3.2)	1.3 (1.2)	-
f	0.5 (1.7)	1.4 (1.9)	-	2.5 (2.9)	2.9 (2.5)	-
dft	4.0 (4.4)	5.3 (2.36)	-	6.4 (3.9)	4.2 (2.8)	-
D	-	2.2 (1.8)	2.2 (3.3)	-	0.9 (1.8)	2.4 (2.9)
M	-	0	0.04 (0.2)	-	0	0.1 (0.4)
F	-	2.5 (1.9)	2.4 (3.4)	-	0.6 (1.4)	1.7 (1.9)
DMFT	-	4.7 (2.7)	4.6 (4.2)	-	1.5 (1.9)	4.2 (3.6)
SiC	8.8	13.8	9.6	10.0	8.6	8.4

of the study parameters. An independent-measures t-test was used to compare the decayed, missing, and filled indices scores of the children with a congenital heart disease and the healthy control groups. All statistical analyses were performed using a statistical software (SPSS version 26.0, SPSS Inc.). Statistical significance was set at 5%.

Results. The mean of decayed and filled primary teeth was higher in children without CHD compared with children in CHD-1 group (6.4 vs.4.0 p=0.095) but this difference was not significant (Table). But the difference between mean of filled teeth in this group was significant (2.4 vs. 0.5, p=0,016). The mean of missing teeth was not calculated in children with primary dentition. Only one child had endodontic complications in CHD-1 group, pufa=1 (p=7, u=0, f=1, a=0). The care index in healthy children group (39.0%) was higher compare with children with CHD.

In mixed dentition the caries experience for CHD and control groups were 5.3 (dft)/4.7 (DMFT) vs. 4.2(dft)/1.5(DMFT) respectively. There were the significant differences in DMFT mean in these groups (p<0,05). Furthermore, the endodontic complications prevalence was dramatically increased in CHD-2 group up to 52,2%. pufa and PUFA mean were 1,77 and 0.06 respectively.

In the group CHD-3 DMFT was 4.6 with SiC mean 9.63, in the control group 4.2 with SiC – 8.4 (p>0.05). Nevertheless, 33.3% of children with CHD had endodontic complications, PUFA mean was 0.33.

Oral hygiene according to VBI index were poor (codes 2 and 3) in 33,3% of children in CHD-1 group. In groups CHD-2 and CHD-3 52,9% and 41.6% respectively had codes 2 and 3.

The prevalence of dental developmental defects was 12% for all examined children with congenital heart diseases.

Basic periodontal examination was performed for children with mixed and permanent dentition. In CHD-2 group 50% of children had at least one sextant with bleeding (score 1), 6,26% with calculus (score 2). In CHD-3 group 8.3% had only bleeding and 25% calculus. There were no children with scores 3 or 4 in this groups.

During clinical examination cyanotic oral mucosa were registered at 64.4% of children, 16.9% had signs of mouth dryness, 1 child (1.7%) had gingival hyperplasia.

Discussion.

The increased prevalence and survival of children with congenital heart disease creates a population with special care needs including dental care. According to the results of our pilot study there were no significant differences in caries experience between children with CHD and healthy children, except DMFT mean in mixed dentition. These results are in accordance with some previous studies of oral health conditions in pediatric population with CHD. Busuttil A. et al. [14], Cantekin K. et al. [15] reported that there was no significant difference in caries experience both in primary and permanent teeth. But the dmft and DMFT scores in these studies were as twice low as in our study. This can be explained by high caries prevalence and caries experience in Ukrainian population. Lower caries experience with low mean of filled primary teeth in children with CHD can be explained by increased prevalence of teeth extractions and not restorations. On the other hand, in children without CHD the prevalence of restorative care is much higher than extractions.

Significantly higher caries experience in primary teeth of children with complex CHD were reported by Stecksén-Blicks C et al. [16] and Pimentel EL et al. [17]. The main risk factors associated with increased caries experience in young children were cyanosis, negative behavior, daily use of medicine, level of education.

Poor oral hygiene was a typical situation for children with CHD in all age groups. The same results

were obtained in the numerous studies [12, 18]. Low level of parents knowledge about link of dental health and infective endocarditis lead to underestimate the importance of oral hygiene [19]. As periodontal health and oral hygiene significantly increase the risk of IE, it is critical to maintain good oral hygiene for children with CHD. Most of the parents hadn't dentist counselling about appropriate home oral hygiene. Hayes PA and Fasules J. [20] reported that up to 78% of cardiac patients had gingivitis.

Dental caries is a preventable disease and appropriate preventive care must be started immediately after teeth eruption. Close cooperation between a cardiologist and a pediatric dentist can improve dental care for such children [21]. A dentist has to screen these patients regularly. The best preventive and treatment option should be used. Primary (prevention of dental diseases) and secondary (prevention of complications) prevention plays an important role. Early caries risk assessment, oral hygiene instructions, fluoride toothpastes in higher concentrations, supervised toothbrushing, diet counseling, application of fluoride varnishes, fissure sealing have to be routinely used for all children with CHD. In case of early caries development, these patients must be immediately referred to pediatric dentists for minimal invasive treatment before extensive caries or endodontic complications will develop. Thereby, early caries treatment is more preferable than endodontic treatment or extractions which might significantly increase the risk of bacteremia and infective endocarditis.

Conclusions. According to limitation of this epidemiological study, there were no significant differences in caries experience of children with congenital heart disease and healthy children in primary, mixed or permanent dentitions. These findings indicate the importance of preventive dental care and appropriate treatment for children with CHD.

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