



Caries Experience and Knowledge About Oral Health Importance Among Children with Congenital Heart Diseases in Kosovo

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ABSTRACT

Objective: To determine the dental health of children with Congenital Heart Diseases (CHD) and to evaluate the parents' knowledge of the importance of oral health and the risk of Bacterial Endocarditis. **Material and Methods:** This research included 140 children divided into the study group (80 children with CHD) and the control group (60 healthy children). The children were from different parts of Kosova, aged between 3-15. The parents were asked to complete a questionnaire containing demographic data (age and gender), general and special medical history (CHD types), knowledge about oral health importance and risk of bacterial endocarditis, and data about the daily oral hygiene child. The caries experience was reported using the DMFT/dmft index. **Results:** The average value of the dmft index was 6.7 for the study group and 5.62 for the control group, while the average value of DMFT index for the study group was 4.1, and for the control group was 3.47 ($p>0.05$). About 68.7% of parents of children with CHD were informed about their risk during dental interventions. However, knowledge was insufficient about the importance of oral health and dental prophylactic measures once only 32.7% of them were aware of those measures. **Conclusion:** No difference was observed between healthy and CHD children in caries experience and frequency of daily tooth brushing. Our findings provide evidence of a lack of knowledge about the importance of oral health and dental prophylactic measures among parents with CHD children.

Keywords: Oral Health; Cardiovascular Abnormalities; Heart Defects, Congenital; Endocarditis, Bacterial.

Introduction

According to the World Health Organization (WHO), oral health has an essential role in overall health and well-being and greatly influences the quality of life. It is defined as a state of being free from mouth and facial pain, oral diseases, and disorders that limit an individual's capacity in biting, chewing, smiling, speaking, or psychosocial well-being [1].

Many chronic diseases can directly impact dental care; the consequences of dental disease or dental treatment may even be life-threatening, for example, congenital heart disease [2]. Therefore, children with medical illnesses should be classified with 'high caries risk' and receive dental prevention measures [2].

Important components that mirror oral health in children are tooth decay and oral hygiene. Studies have shown increased poor oral hygiene and caries risk in children with Congenital Heart Diseases (CHD) [1,3]. In addition, the prevalence of caries in children with CHD is significantly higher than in healthy children. Negligence for good oral hygiene and a healthy diet can be a risk factors for dental bacteremia and Bacterial Endocarditis (BE) [3]. Tooth decay continues to be the most common and prevalent disease in humanity [4]. One of the main causes of caries is dental plaque microorganisms [5-7]. Caries is related to the level of acidogenic bacteria in the oral cavity, especially streptococcus mutans (SM), as well as lactobacilli, which can demineralize enamel. These bacteria increase carbohydrate metabolism, creating a low pH, but they are not the only cause of caries [8]. Caries could occur in the absence of these species, while the streptococcus mutans may be present at a high level without enamel demineralization [6,8]. However, streptococcus mutans is considered to have a major role in the development of BE in patients with CHD [9,10].

The CHD incidence is relatively high in developing countries while low in most developed countries. These abnormalities occurs in 8-10 per 1000 live births or 0.8-1.0% at global level [11]. There are many CHD types, some of which are also characterized as symptoms of various syndromes. The classification is based on distinct anatomical, hemodynamic and clinical criteria. The most commonly used classification in general practice includes three groups [2,4,8]: 1) Abnormalities without pathological communication between systemic and pulmonary circulation, 2) Abnormalities with left-right shunt, and 3) Right-left shunt anomalies.

In daily dental practice, children with CHD present the largest group of medically compromised patients. Therefore, knowledge of all types of CHD is essential for the pediatrician and the dentist due to the risk of developing BE from oral cavity diseases and dental treatments.

The initiating factor for BE is transient bacteremia, or the entrance of microorganisms into the bloodstream [7-10]. One of the most common causes is Streptococcus viridans (SV), a component of the normal oral flora and the upper respiratory tract. Some species of SV have been reported to be found in transient bacteremia after dental manipulations [12-14]. Bacteriological studies have shown that after tooth extraction, transient bacteremia is induced for 15-20 min. Under normal conditions, it is withdrawn without any harmful effects, but in cases that include heart abnormalities, there is a risk of developing BE [9,13-16].

Antibacterial prophylaxis recommendations are constantly updated [2]. According to the American Heart Association (AHA), based on the degree of risk for BE, patients with CHD are classified into three groups, high-risk, moderate-risk, and negligible-risk [17,18].

Prophylaxis against infective endocarditis is reasonable before dental procedures involving gingival tissue manipulation, the periapical region of teeth, or perforation of the oral mucosa in patients with high risk. The 2007 AHA guidelines state that an antibiotic for prophylaxis should be administered in a single dose before the procedure (2g of amoxicillin or 50mg/kg) [17,18].

The most important thing to consider when planning dental care for children with CHD is the prevention of dental diseases. These children should be referred for a dental evaluation and an aggressive preventive regimen, including dietary counseling, fluoride therapy, fissure sealants, and oral hygiene instruction [2,8]. Antibiotic prophylaxis before dental interventions is problematic because transient bacteremia and BE can also be caused spontaneously without intervention [19].

There is a large number of studies from different countries which report data on dental status and other oral diseases in children with CHD. Congenital heart defects do not directly affect caries development, but high caries prevalence can be interpreted as a consequence of oral health neglect [5,7,14,18,20].

The aim of this research is to determine the dental health of children with CHD compared to healthy children, to evaluate oral health care of these children, as well as to evaluate the parent's knowledge of the importance of oral health and the risk of Bacterial Endocarditis.

Material and Methods

Study Design and Participants

This research was conducted in the Dental University Clinical Center of Kosova (UDCCK) in collaboration with the Pediatric Clinical Center of Kosova. The research included 140 children who were divided into the study group and the control group. The study group comprised 80 children with various types of congenital heart diseases (CHD), while the control group comprised 60 healthy children.

The following inclusion criteria were adopted: children in the study group were made sure to have CHD's of various types but only those not included in other syndromes such as Down syndrome, Turner syndrome, Williams syndrome, or any chronic disorders. As controls, the children without general diseases were included in the current study. The children were from different regions of Kosovo, aged between 3-15, and of both genders. They were separated into three age groups: 3-5 years - children with deciduous dentition; 6-10 years - children with mixed dentition; and 11-15 years - children with permanent dentition. Excluding criteria: children were excluded from the research if their medical history provided data on other chronic diseases and syndromes in addition to CHD.

To conduct this research, we initiated a collaboration with the Pediatric Clinical Center, Department of Cardiology. Patients with CHD were initially advised by their pediatrician for a dental examination and were required to have their medical history at the dentist.

Data Collection

The parents were asked to complete a questionnaire containing demographic data (age and gender), general and special medical history (CHD form), knowledge about oral health importance and risk of bacterial endocarditis, and data about the daily oral hygiene of their child. Patients were advised to maintain oral hygiene at the first visit and the way of brushing their teeth was also demonstrated. The questionnaire includes 13 questions, and the oral examination data were collected by two specialists in pediatric dentistry (experienced examiners). The caries experience was reported according to the World Health Organization (WHO) criteria for primary dentition (dmft index) and permanent dentition (DMFT index); the sum of decayed teeth, missing teeth due to caries, and filled teeth index.

Data Analysis

For statistical analysis, data were analyzed using IBM SPSS software (IBM Corp., Armonk, NY, USA). Statistical differences between the dental status of the CHD and healthy group were determined using the t-test, and the level of significance was set at $\alpha = 0.05$. For the frequency of daily tooth brushing between the two groups Kruskal-Wallis test was used, and the significance level was $p < 0.01$.

Ethical Clearance

The study was approved by University Dentistry Clinical Center's Ethics Committee, reference number 03/1130. Additionally, written informed consent was obtained from the participants' parents.

Results

The mean value of the dmft index for children with the primary dentition of the CHD group was 6.7 (± 4.1), with the lowest value being 0 and the highest being 18. The mean value of the DMFT index for the children in the control group was 5.62 (± 3.33), in which the lowest value was 0 and the highest was 13. While using the t-test, we did not obtain a significant difference between the mean values of the dmft index among the two groups ($p > 0.05$). Children with CHD with primary dentition had a dmft = 0 in 1.85% of the cases and a dmft > 0 in 93.75% of the cases (Table 1).

Table 1. Average values of dmft index among congenital heart diseases and healthy children.

| Age Group | | Children with Congenital Heart Diseases | Healthy Children | p-value |
|------------|---------------|---|------------------|---------|
| 3-5 Years | N | 23 | 16 | >0.05 |
| | Mean \pm SD | 7.39 \pm 4.73 | 5.56 \pm 4.30 | |
| | Range | 2-18 | 0-13 | |
| 6-10 Years | N | 31 | 23 | >0.05 |
| | Mean \pm SD | 6.19 \pm 3.53 | 5.65 \pm 2.92 | |
| | Range | 0-16 | 0-12 | |
| Total | N | 54 | 39 | >0.05 |
| | Mean \pm SD | 6.7 \pm 4.1 | 5.62 \pm 3.33 | |
| | Range | 0-18 | 0-13 | |

The mean value of the DMFT index for permanent dentition among children with CHD was 4.1 (± 3.43), where the lowest value collected was 0 and the highest was 18. The mean value of the DMFT index for children of the control group was 3.47 (± 3.6), where the lowest value collected was 0 and the highest value collected was 14. There were no significant differences concerning the DMFT index in children with permanent dentition ($p > 0.05$) (Table 2).

Table 2. Average values of DMFT index among congenital heart diseases and healthy children.

| Age Group | | Children with Congenital Heart Diseases | Healthy Children | p-value |
|-------------|---------------|---|------------------|---------|
| 6-10 Years | N | 31 | 23 | >0.05 |
| | Mean \pm SD | 2.2 \pm 1.82 | 2.2 \pm 1.9 | |
| | Range | 0-6 | 0-5 | |
| 11-15 Years | N | 26 | 21 | >0.05 |
| | Mean \pm SD | 6.23 \pm 3.58 | 6.09 \pm 4.86 | |
| | Range | 0-16 | 0-12 | |
| Total | N | 57 | 44 | >0.05 |
| | Mean \pm SD | 4.1 \pm 3.43 | 3.47 \pm 3.6 | |
| | Range | 0-18 | 0-14 | |

A total of 68.7% of parents of children with congenital heart diseases were informed about the risk of development of BE during a dental intervention. The main source of information on knowledge about the risk of bacterial endocarditis, the information was predominantly received by pediatricians (83.6%; n=46), dentists (9.1%; n=5), and others (7.3%; n=4).

About 67.3% of parents of CHD children were unaware of the importance of oral health and dental prophylactic measures such as oral hygiene, regular dental check-ups, fluoridation, and tooth sealing, which would prevent the risk of BE from oral cavity diseases. In comparison, only 32.7% knew these measures.

Half of the children with congenital heart anomalies (50%) brushed their teeth once a day, 7.5% of them twice or more per day, 38.8% of them rarely, and 3.8% never brushed their teeth. Within the control group, 41.9% rarely brushed their teeth, followed by those who brushed their teeth once a day (37.1%), those who brushed their teeth twice or more times per day (14.0%), and those who never brushed their teeth (7.0%). There was no significant difference in the frequency of daily tooth brushing between the two groups ($p>0.05$) (Figure 1).

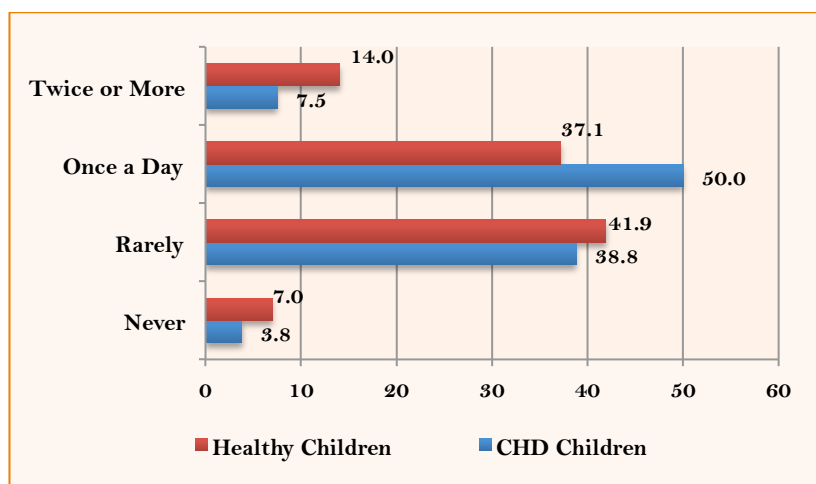


Figure 1. Daily oral hygiene of children with CHD compared to healthy children.

Discussion

This study is based on oral examination and dental status of CHD children compared to healthy controls and on a questionnaire for their parents. The results obtained in our study provide data on insufficient oral health care for two groups, CHD and healthy children, without significant statistical importance.

Different studies have provided evidence that oral cavity diseases and dental interventions are risk factors for developing bacterial endocarditis in CHD children [21-27]. Many authors provide data on dental status and other oral cavity diseases. However, most of them have not reported the statistical significance of dental status in children with CHD compared to healthy children, although the oral health condition in many of them was reported to be worse in children with CHD. Despite all these findings, they concluded that the high prevalence of caries and poor oral hygiene is not a consequence of the direct impacts of heart anomalies but a consequence of the neglect of oral health care [5,7,16,21,26].

The caries experience for primary and permanent dentition was higher for both groups of children in our study (dmft=6.7; DMFT=4.1) in comparison to research from other authors [7,23,26]. Due to the lack of programs for oral health promotion and insufficient application of prophylactic caries measures, our country has a high level of caries. Children with CHD had higher caries prevalence values than healthy children,

although not significantly different. This is justified by the fact that the parents of these children are more committed to general health and heart disease and neglect oral health.

Bagesund et al. [26] showed that the mean of dmft was 5.8, and for permanent dentition, DMFT was 4.9 among children with CHD from Bosnia and Kosovo. A total of 26 children with a mean age of 4.5 (0.8-17.2) underwent dental examinations prior to heart surgery. The authors concluded that these children need oral prophylactic measures [26]. Similar results were reported by Pimentel et al. [23], with a dmft value of 5.4 in children with CHD in Brazil. Da Silva et al. [7], in their research on the oral health status of children at risk of BE, report the following data: for primary dentition, the dmft mean value was 9.7, while for permanent dentition, the DMFT mean value was 2.62.

Another component in our research regarded the knowledge of parents of CHD children about the risks of development of BE from dental interventions. According to our results, 68.7% of parents knew the risks to the child's general health. They also were aware of taking antibiotics before dental interventions, but they didn't know in which cases they should take them. Most of them (83.6%) were informed of this by their pediatrician, who is usually their first contact. Our results show that more than half of the parents were aware of the risk of the BE during dental treatment. Unfortunately, they were not informed about the administration of antibiotics: the dose and the time when it should be taken. As a result, some patients received antibiotics even when it was unnecessary (e.g., treatment of the initial carious lesion), or others received insufficient doses to avoid the risk from the BE. This may increase antibiotic resistance.

Our results are consistent with those reported by Balmer et al. [15] in their research on the oral health experience and dental prevention of children with CHD, in which only 64% of parents knew about the link between oral health and CHD. Franco et al. [27] and Saunders and Roberts [21] found that parents of these patients are more concerned about other diseases such as colds, traumas, or systemic infection than oral health. Pimentel et al. [23] found a similar frequency in which 51.4% of parents knew the importance of antibiotic prophylaxis, but only 20.1% understood its purpose. Knirsch et al. [28], in their research on the knowledge and practice of antibiotic prophylaxis, give the data that 37.5% of children and their parents do not know the risk and possibility of developing BE. According to Da Silva et al. [7], 60.6% know the possibility of developing heart problems after a dental intervention. They also report that most of them (74.4%) have been informed by a pediatric cardiologist, while only 16.3% have been informed by a dentist [7].






Our study shows that only 32.7% of parents of CHD children were aware of the importance of oral health and dental prophylactic measures. Dental visits of children in our country are rare. Usually, children visit the dentist when they have pain or already need conservative treatment or extraction. As a result, there is a lack of knowledge about the importance of oral health and dental prophylactic measures. Also, Da Silva et al. [7] found that 41.3% of parents understood the importance of good oral health to prevent BE.

Regarding the frequency of daily tooth brushing, 7.5% of children with CHD brushed their teeth twice daily, compared to 14% of healthy children. Half of the children with CHD brushed their teeth once daily, and the brushing techniques were inappropriate. During the intraoral examination, we found a high presence of dental plaque and poor oral hygiene. Ali et al. [20] found that children with CHD had lower frequencies of brushing their teeth and using fluoridated toothpaste, and their caregivers were less knowledgeable about caries. Schulz-Weidner et al. [3] found that healthy children brushed their teeth significantly more often (65.4%) than children with CHD (45.1%). Only 75% of children with CHD used fluorides daily compared to 86.6% of healthy children [3].

Conclusion

Our findings provide evidence of a lack of knowledge about the importance of oral health and dental prophylactic measures among parents with CHD children. Although the value of the dmft/DMFT index was slightly higher for the CHD group, no difference was observed between healthy and CHD children regarding caries experience and daily frequencies of brushing their teeth. Considering the fact that these children are at risk for the development of BE, an improvement in education in the prevention of dental caries, a brushing routine, and regular dental check-ups are needed.

Authors' Contributions

| | | | |
|---|---|---|---|
| AR |  | https://orcid.org/0000-0003-3426-8665 | Conceptualization, Methodology, Formal Analysis, Investigation, Data Curation, Writing - Original Draft and Writing - Review and Editing. |
| BX |  | https://orcid.org/0000-0002-3000-1632 | Conceptualization and Writing - Review and Editing. |
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| SB |  | --- | Data Curation and Writing - Review and Editing. |
| DA |  | https://orcid.org/0000-0002-0061-2723 | Methodology, Formal Analysis and Writing - Review and Editing. |
| All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published. | | | |

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None.

Conflict of Interest

The authors declare no conflicts of interest.

Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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