

ORIGINAL PAPER

Oral health among children with cardiovascular disease and risk of infective endocarditis

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Abstract

Objective: The purpose of our study was to assess the oral health of a sample of children with cardiovascular conditions who have been recommended to prevent infective endocarditis.

Methods: The prevalence of cavity in temporary and permanent dentition was assessed by determining the dmf-t index, DMF-T index and the analysis of their components (dt, mt, ft, DT, MT, FT). Inclusion in the study was based on two criteria: children at risk of developing infective endocarditis; age between 6 and 12, representing the period of mixed dentition.

Results: dmf-t index reaches the highest score around the age of 9 and the lowest score at the age of 10. For the DMF-T index, the highest scores are found in 10-year-old children and the lowest in 8-year-olds. The evolution of the DT and FT components has been emphasized. Compared to DT, which has scored above 0.5 in all ages except 6 years old, FT is very weakly represented, with very low scores (under 0.5) in only 3 of the 7 age groups.

Conclusions: Children with cardiac anomalies who follow chronic medicine treatment present a high risk of developing the dental cavity. In the context of preventing infective endocarditis, the monitoring of patients with cardiac conditions and the maintenance of rigorous oral hygiene are unsatisfactory.

Keywords: cardiovascular disease, endocarditis, cavity, temporary dentition, permanent dentition.

Introduction

Congenital cardiac diseases are the most common and severe anomalies present at birth, with a significant impact on infant morbidity and mortality. In Romania, 1,500-1,600 babies with congenital cardiac diseases are born every year. Of these, 850-950 a year require surgical correction. Each of these babies' hospital discharge sheet recommends preventing infective endocarditis. For this reason, treating these patients is a challenge not just for pediatricians, but also for pediatric dentists or dentists in general. Firstly, these children are predisposed to developing infective endocarditis as a consequence of bacteremia induced by dental procedures.

Secondly, children whose health is severely affected can have a low tolerance to the stress induced by dental treatment. Thirdly, hematological, respiratory and neurological complications, as well as any chronic medication administered, must be taken into account when preparing a dental treatment plan for children with congenital cardiac conditions [1, 2]. Certain authors believed that the role of dental procedures in inducing infective endocarditis had been overestimated

[3, 4]. The prevention of bacterial endocarditis in the case of children at risk involves both parents and pediatric dentists knowing the risks these children are exposed to, as well as the responsibilities they have.

One can often note the parents' lack of knowledge regarding bacterial endocarditis, even after they have been informed on it during the child's routine cardiology visit. Dentists also seem to present a knowledge deficit about indications and the regimen for administering antibiotic prophylaxis, required for the prevention of bacterial endocarditis [5].

The purpose of this study was to assess the oral health of a sample of children with cardiovascular conditions who have been recommended to prevent infective endocarditis. This study is cross-sectional, and it was carried out during 2014 and 2015, involving a group of 37 children 25 girls and 12 boys directly observed and treated in the Pediatric Cardiology Clinic of Tirgu Mures.

Material and method

Inclusion in the study was based on two criteria: 1. Children at risk of developing infective endocarditis; 2. Age between 6 and

12, representing the period of mixed dentition. The study group consisted of 37 patients: 25 children with congenital cardiac anomalies, 7 presenting pulmonary hypertension and 5 with cardiomyopathy. The sample contained nine children aged 6 years, six children aged 7 years, five children aged 8 years, seven children aged 9 years, two children aged 10, three children aged 11 and five children aged 12. Their background was not a reference element for the study so that children from both rural and urban backgrounds were included in the study. The protocol involved a clinical examination as per the recommendations of World Health Organization. The results were recorded in specially designed sheets. The dental health indices were calculated to emphasize the patients' cavity experience and oral health. The prevalence of cavity in temporary dentition was assessed by determining the *dmf-t* index and analyzing its components (*dt*, *mt*, *ft*). The incidence of the cavity in permanent dentition was evaluated based on the DMF-T index and the analysis of its components (DT, MT, FT).

Results

The age average was 8.43 years old, 6-year-olds being the most numerous. The *DMF-T index* reached scores from 0 to 6, except score 5, for which the number of patients was 0.

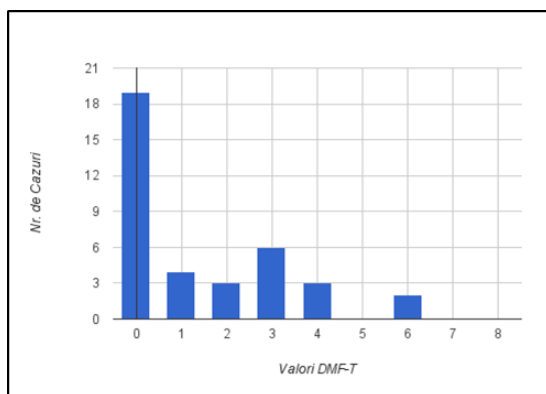


Figure 1. Distribution of patients with similar DMF-T scores

The highest DMF-T average scores were found in subjects diagnosed with congenital cardiac anomalies, while the highest average

More than half of the patients obtained a score of DMF-T = 0; the maximum index score was present in less than 3 cases (figure 1).

Concerning the *dmf-t index*, in our study, the index reached scores between 0 and 8; no patients achieve a 7. In the case of temporary teeth, most patients obtained a score of 0 (10 cases) or 1 (6 cases), and three patients a score of 8 (figure 2).

Depending on age, we assessed the evolution of the *dmf-t* index. It reaches the highest score around the age of 9, and the lowest at the age of 10. For the DMF-T index, the highest scores are found in 10-year-old children and the lowest in 8-year-olds.

The evolution of the DT and FT components according to age groups is illustrated in figure 3. Compared to DT, which has scored above 0.5 in all ages except six years old, FT is very weakly represented, with very low scores (under 0.5) in only 3 of the seven age groups.

In the case of temporary teeth, *ft* has scored only for the ages of 6 and 7, but even then, the scores are very low (<1). On the other hand, *dt* has high scores in all ages, up to and including 11, which is the age when the *dt* component reaches maximum level.

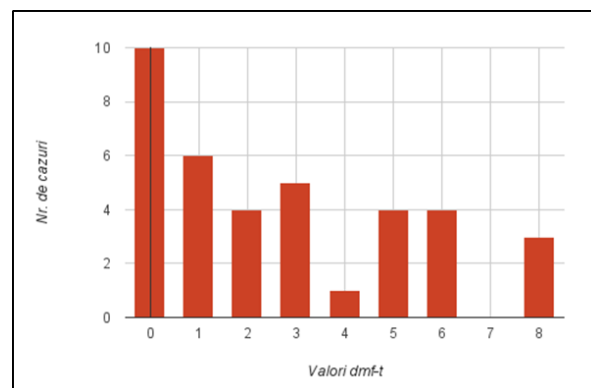


Figure 2. Distribution of patients with similar *dmf-t* scores

scores for the *dmf-t* index were recorded in subjects diagnosed with pulmonary hypertension.

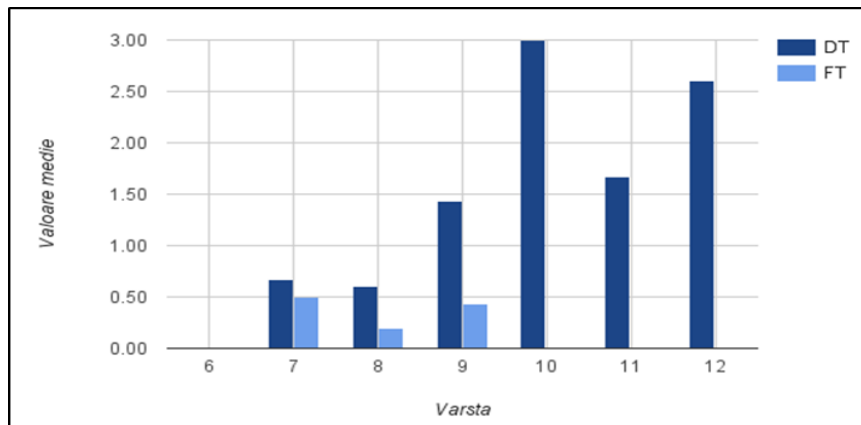


Figure 3. The evolution of DT and FT indices according to age

Discussion

The results of this study indicated a significant difference between scores obtained for dmft and DMFT indices; the average score for dmft ($=2.72$) was almost double that for DMFT ($=1.40$); therefore, the subjects of this study present a better state of oral health for their permanent dentition than for their temporary dentition. Stecksén-Blicks et al. obtained results in concordance with those of our study. In their study both the dmft (average score 5.2) and the DMFT (average score 0.9) indices of the sample of children with cardiac conditions (obviously, the average dmft score $>$ the average DMFT score) have high levels compared to the control group [6].

Therefore, children diagnosed with cardiac conditions have a superior dental status in their permanent teeth compared to the temporary ones. The aspect can be explained by a series of situations which occur in the context of the general conditions these children suffer from, situations which may affect their dental health. For instance, many of the children have nutrition-related problems during their first year of life. Vomiting is a common problem, and to compensate this, they should frequently be fed, while nightly meals are often required to maintain the energy intake at an acceptable level. Moreover, some of the medication administered for cardiac diseases contains sugar and diuretics, which can cause xerostomia.

Infections last longer than in the case of healthy children; there is a high requirement for liquids, especially at night, when salivary protection is lower [6]. All these aspects have

repercussions mainly on the health of temporary teeth.

The high incidence of the cavity in temporary teeth compared to permanent teeth in the case of children with cardiac conditions can also be explained by El-Hawary and his collaborators' conclusion: congenital cardiac conditions affect the chemical structure and composition of temporary teeth [7]. Enamel has a protective role for the tooth; loss of enamel exposes the sensitive dentine underneath. Once deteriorated, enamel is generally impossible to recover [8]. El-Hawary's study proves the occurrence of alterations in the enamel and dentine of temporary incisors in patients with congenital cardiac diseases. Changes were found both in ultrastructure and in mineral content (Ca and P) in the enamel and dentine [7]. Hallet et al. reached the same result in their study: the average score for dmft ($=4.2$) is higher than the DMFT score ($=0.9$) in a sample of 39 children diagnosed with congenital cardiac conditions [1].

It is worthy of mention that, in the three studies mentioned above, it is in our study that dmft indices have the lowest scores. Stecksén-Blicks' study [6], performed on a sample of Swedish children, has the highest dmft scores ($=5.2$), followed by the sample of children from Northern Australia, examined by Hallet ($=4.2$). Romania, represented by a sample of children from TirguMures, has significantly lower dmft scores ($=2.75$).

There also are studies which did not find significant differences between the scores of the two indices, such as the study carried out

by Talebi et al., involving a sample of children with cardiac conditions. Comparatively, they also studied a sample of healthy children, the results being similar to those obtained for the study sample [9]. The results obtained by Talebi et al. are related to two other studies in specialized literature [10, 11]. Silva et al. [3] obtained higher scores for DMF-T compared to dmf-t. However, it should be noted that their study aimed to establish oral health status in a sample of 104 children aged between 2 and 17. Thus, even if the sample consisted of children at risk of infectious endocarditis, the age groups studied by Silva et al. make it difficult to compare the results with those obtained in our study.

About average scores according to age groups, the results obtained in our study cannot be included in a specific pattern; average scores do not decrease or increase with age. Thus, the maximum average score for temporary teeth is found at the age of 9 (=4.14), and the minimum average score at the age of 10 (=1.00). At seven years of age, the average score is 3.60, while at 12 years of age it is 1.25. The same situation resulted in the case of permanent teeth; the maximum average score was recorded at the age of 10 (=4.00), and the minimum score at the age of 6 (=0).

A study carried out in Romania on a sample of children aged between 7 and 12 from rural areas in Dolj County, attracted our attention by its results, which we considered comparable to those of our study, even though the study in question was performed on a sample of clinically healthy children. Bătăiosu et al. [12] indicated that the average scores for temporary teeth decrease once the subject's age; average scores are directly proportional with age. The maximum score for the dmf-t index was found at the age of 7 (=4.11), and the minimum score at the age of 12 (=0.52). In the same study, the average scores of the DMF-T index followed age groups according to a specific pattern, like in our study, scores being directly proportional to age. Thus, the minimum average score for the index (=0.55) was recorded at the age of 7, and the maximum average score (=3.33) at the age of 11.

The average scores obtained by Bătăiosu and his collaborators are very close to the ones in our study: average score 2.56 for dmf-t index and 1.87 for the DMF-T index, compared to an

average score of 2.72 for the dmf-t index and 1.40 for the DMF-T index found in our study. It is essential to specify once more that Bătăiosu's [12] study sample consisted of healthy children, whereas our sample consisted of children with acute cardiac conditions. However, we can note that, in the case of permanent dentition, children with cardiac conditions have a dental health status superior to healthy children. Since this surprises us, we can ask whether the rural background of the healthy children may be the cause of these scores.

To be able to answer this question, we analyzed the results obtained by Fleancu [13], who studies the oro-dental status of primary school children in two schools in Sibiu. The schools were selected because they both had a dentist's practice. The DMF-T index had an average score of 1,71 for the entire sample, a score which is lower than that found for children in the rural environment (=1.87), but higher than the score obtained by children with cardiac conditions (=1.40).

Therefore, healthy children in urban schools which are equipped with dental practices have an inferior dental status to healthy children in the rural environment, but with insignificant differences, while the sample of children with cardiac conditions has a better dental status. It is important to note that antibiotics are prescribed for the prophylaxis of infective endocarditis, so it is possible that medication may induce a prophylactic effect on cavities [6].

Another explanation for the favorable dental status of subjects with cardiac conditions compared to healthy subjects may be the indication they have all received, namely the prophylaxis of bacterial endocarditis; in this context, regular dental check-ups and rigorous oral hygiene ensure an explanation to the situation.

Concerning parent knowledge on the prophylaxis of endocarditis, Balmer et al. specified that 64% of parents were aware of the relationship between their children's oral health and infective endocarditis [11]. Cheuk et al. [14] conclude that the parents of children with congenital cardiac conditions have essential knowledge gaps regarding their children's disease, and suggest that the current educational program is inadequate. The study

performed by Nath et al. [15] reached similar conclusions, namely that only 8% of parents were aware of the importance of good oral and dental hygiene and the need to prevent infective endocarditis.

Another important aspect emphasized by our study was the scores reached by the components of the indices - dt, ft / DT, FT. The scores suggest that the rate of dental treatment is very low, both in the case of temporary dentition and permanent dentition, even though the need for treatment exists and is recommended.

Conclusions

Children with cardiac conditions have a better state of oral health for permanent dentition than temporary dentition. Children with cardiac anomalies who follow chronic medicine treatment present a high risk of developing the dental cavity. In the context of preventing infective endocarditis, the monitoring of patients with cardiac conditions and the maintenance of rigorous oral hygiene are unsatisfactory.

Patients see a dentist only when forced by the imminence of heart surgery, to eliminate dental hotbeds. An effort is required on the part of pediatricians and pediatric cardiologists to make parents aware of the importance of oral hygiene and the necessity to prevent infections in children with cardiac conditions.

Conflict of interest: None to declare.

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