

# Oral Health of Children with Congenital Heart Disease at a Pediatric Health Science Centre

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## Abstract

**Objective:** We undertook this study to determine the oral health status of children with congenital heart disease (CHD) requiring cardiac surgery treated at a pediatric health science centre.

**Methods:** We reviewed the health records of children with CHD who required cardiac surgical intervention and who also had a dental consultation between 2007 and 2011. We recorded demographic data, cardiac diagnoses, comorbidities, number of cardiac surgeries, reason for referral for dental assessment, chief dental complaint and treatment delivery method and calculated measures of caries experience and treatment costs.

**Results:** Of the 156 patients who met the eligibility criteria, 72 patients (46%) received dental extractions and/or restorations in addition to consultation. Their mean age at the time of treatment was  $43 \pm 30$  months. The mean decayed, extracted and filled primary teeth (deft) was 8.6. Dental treatment was performed under general anesthesia in 83% of cases. Average treatment experience was 2 extractions and 4 restorations per child.

**Conclusion:** Almost half of children with CHD who presented for dental consultation had severe early childhood caries.

Dental caries is the most common childhood disease.<sup>1</sup> Early childhood caries (ECC) is an infectious, transmissible, diet-dependent disease, characterized by the presence of one or more decayed, missing or filled tooth surfaces on any primary tooth in a preschool-age child.<sup>2</sup> Evidence of smooth-surface caries in children younger than 3 years of age is indicative of severe ECC.<sup>3</sup> Children with a history of ECC are at greater risk for future dental caries than children with no caries experience.<sup>4</sup> Caries left untreated places a child at risk for dentoalveolar infection, cellulitis and systemic complications.

Children with congenital heart disease (CHD) have a higher prevalence of caries and a greater proportion of untreated caries lesions than healthy children.<sup>5-11</sup> In addition to the risk of dentoalveolar infections, children with CHD who require cardiac surgical intervention are also at risk for infective endocarditis.<sup>12</sup> Despite these increased risks, a high proportion of children with CHD have never had a dental examination,<sup>5,7,10,13</sup> even though one is recommended for all children by 12 months of age.<sup>14</sup>

The role of bacteremia in the risk of infective endocarditis, its frequency, magnitude and etiology, be it from dental cleanings or daily living activities, is unclear. However, current data support the importance of maintaining good oral health, preventing dental and gingival diseases and seeking dental care in an overall effort to reduce the risk of infective endocarditis.<sup>15</sup>

Non-dental health care providers may not be aware of the impact of poor oral health on systemic health or the risks of dental disease for children with CHD, or they may be distracted by the multiple demands, stresses and challenges associated with caring for a child with CHD such that oral care is overlooked.<sup>16</sup>

We undertook this retrospective investigation to determine the oral health status of children with CHD treated at a large pediatric hospital in Toronto, Canada.

## Materials and Methods

The Division of Cardiology at The Hospital for Sick Children maintained a registry of all children with CHD under its care. The medical and dental records of children diagnosed with CHD, who had cardiac surgical intervention and who also had a dental consultation at The Hospital for Sick Children from May 2007 to May 2011 were reviewed. Records with incomplete data were excluded. The following data were recorded:

- Reason for referral for dental assessment
- Sex and age at treatment
- Medical history: cardiac diagnoses, comorbidities, cardiac surgical interventions
- Dental history: chief complaint, type of dental interventions provided, method of delivery of dental treatment, indications for selected treatment method

From the data collected, we calculated the proportion of children with CHD who required dental intervention, the decayed, extracted and filled teeth (deft) and decayed, missing and filled teeth (DMFT) indexes (a caries prevalence measure),<sup>17</sup> procedures performed and treatment costs.

## Statistical analysis

Continuous variables are reported as mean plus or minus standard deviation. Categorical variables are reported as proportions.

## Ethics approval

This study was approved by the Research Ethics Board of The Hospital for Sick Children (REB no. 100002817).

## Results

Children with CHD were referred to the Department of Dentistry for one or more of the following reasons: dental assessment before cardiac surgery (51%), caries lesions detected by dentists in the community (44%) or primary dental care in a hospital setting as requested by cardiologists or dentists in the community (20%).

Of the 156 children whose records met the inclusion criteria 72 (46%) had severe ECC and an associated cardiac diagnosis (**Table 1**). The most prevalent associated non-cardiac comorbidities were developmental delay (30%) and 22q11.2 deletion (or DiGeorge) syndrome (5%). The number of cardiac interventions per child within this group ranged from 1 to 5 (**Table 2**).

Of the 72 children requiring dental treatment, 83% were treated in the operating room under general anesthesia, 7% in the dental clinic under local anesthesia and 3% were treated at different times in both locations. The mean age at the time of dental intervention was  $43 \pm 30$  months. Distribution by sex was 48% female and 52% male. Sixty patients (83%) required general anesthesia for dental treatment once, while 7 (11%) required general anesthesia a second time for the treatment of recurrent caries. Indications for treating under general anesthesia can be seen in **Fig 1**.

The deft for children with CHD who had cardiac surgical intervention and dental treatment was 8.6, and the average number of untreated decayed teeth was 8. The most common dental interventions were restorations and extractions. The average treatment experience for each child was 4 restorations and 2 extractions. The mean cost of dental care for patients was \$2154.

## Discussion

Dental caries is the most common childhood disease and is a public health concern worldwide. Severe ECC can produce pain and infection and have a negative impact on growth, nutrition,<sup>18</sup> psychosocial well-being and overall quality of life in any child.<sup>2</sup> Children with CHD and dental caries face the additional risk of infective endocarditis, as the oral cavity may be a source of bacteremia. Untreated

dental caries may also lead to delay or cancellation of cardiac surgery, increasing the risk of morbidity and mortality.<sup>19</sup>

Almost half of the children (46%) in this investigation with complex CHD referred for a dental consultation in advance of their scheduled cardiac surgical intervention presented with severe ECC and a deft index of 8.6. More important was the high proportion of children with untreated decayed teeth (dt = 8) in our sample, compared with healthy children of similar age from the same urban area, whose deft and dt were 1.2 and 0.4, respectively.<sup>20</sup> The average of decayed untreated teeth in our sample was almost 18 times values reported by Leake and colleagues<sup>20</sup> in a group of 5-year-old healthy children who lived in Toronto and had a average of 0.42 untreated decayed teeth.

Previous studies have also shown that children with CHD have high levels of dental caries.<sup>6-8</sup> Pimentel et al.<sup>21</sup> sampled 144 records of 3-to-5-year-old children with CHD, who demonstrated a high level of caries as demonstrated by deft scores of  $5.4 \pm 4.9$ ; 80.5% had at least one caries lesion.

Although our study did not have a sex- and age-matched retrospective control group of children with non-CHD, our results demonstrate a high level of untreated decayed teeth and revealed the importance of early referral to dental care professionals to reduce the incidence and severity of disease.

Poor daily oral hygiene combined with a cariogenic diet is common in this patient group. Chronic administration of sugar-based liquid medications and reported disproportionate parental anxiety related to perceived risks for their child in stressful situations, such as dental consultations and treatment, add to the risk of dental disease and associated cardiac risks.<sup>5-8,15</sup> Suvarna et al.<sup>22</sup> reported that children with CHD presented with poor oral health, measured by simplified oral hygiene and gingival indices, compared with healthy children, indicating a lack of knowledge regarding oral hygiene.

Other potential factors associated with a higher prevalence of dental caries and untreated decayed teeth in children with CHD include a high incidence of developmental defects of enamel,<sup>6,9,10</sup> high incidence of gastroesophageal reflux with associated acid erosion of teeth,<sup>5,10</sup> frequent ingestion of sweetened nutritional supplements,<sup>10</sup> xerostomia induced by medications,<sup>5</sup> low priority placed on oral care because of the severity of the cardiac disease<sup>5</sup> and parental overindulgence.<sup>5</sup>

Children with CHD are less likely than healthy children to have had a dental consultation despite the recommendation that all children have an oral assessment by age 1 year.<sup>5,7,10,12,13</sup> Non-compliance with recommendations

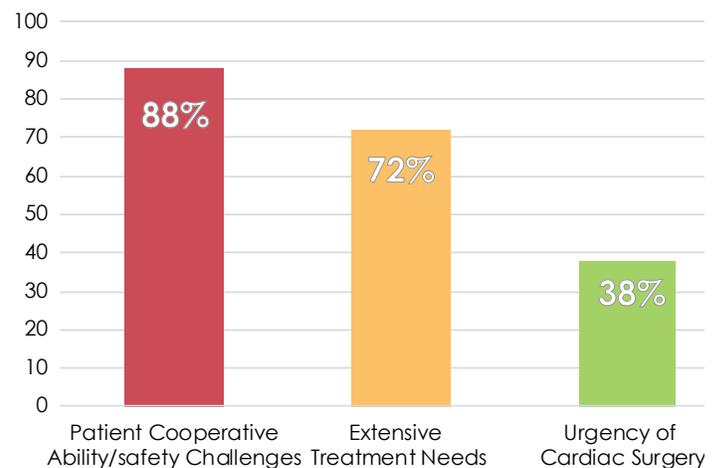
**Table 1:** Diagnoses of congenital heart defects of children who presented with ECC ( $n = 72$ ). Some children presented with more than one cardiac defect.

Type of congenital heart defect	No.	%
Ventricular septal defect	20	28
Tetralogy of Fallot	13	18
Hypoplastic heart syndrome	12	16
Coarctation of aorta	11	15
Atrial septal defect	10	14
Atrioventricular septal defect	8	11
Transposition of the great arteries	8	11
Pulmonary valve stenosis	6	8
Aortic valve stenosis	5	7
Patent ductus arteriosus	4	5
Pulmonary atresia	2	3
Single ventricle defects	2	3

**Table 2:** Number of cardiac interventions per child who presented with ECC ( $n = 72$ ).

Interventions	No. children	%
1	29	40
2	20	28
3	11	15
4	9	13
5	3	4

**Figure 1:** Indications for treatment under general anesthetic.



for early professional oral assessment may be a result of factors related to the cardiac disease, such as long hospital stays and appointment fatigue,<sup>8</sup> or family attitudes and knowledge about oral diseases.<sup>5,8,10,12,23</sup> Access to care may

be negatively affected if suitably trained and experienced dental/medical professionals are not geographically convenient.<sup>24</sup> The financial burden of dental treatment may also discourage parents from seeking dental consultation and treatment. Finally, sedation or general anesthesia is often required to complete this patient population's treatment needs, but appropriately trained health care professionals and clinical resources to support the delivery of dental treatment using these modalities may not be conveniently available.

Dental surgery is the most common day surgery procedure at most pediatric hospitals in Canada.<sup>2</sup> This study has shown that most children with a cardiac lesion referred for dental consultation who presented with caries required treatment under general anesthesia. Although a general anesthetic for dental intervention is frequently needed, it imparts additional risks of morbidity or mortality when required in advance of corrective cardiac surgery or for children with unstable cardiac conditions. Because dental caries is a preventable disease, health care providers who treat children with CHD should consider a more collaborative approach to ensure oral health is optimized in this at-risk population. This can be achieved by a combination of awareness of health care providers of the importance of oral health and its role in systemic health and "front-line providers" emphasizing to parents the importance of a non-cariogenic diet, initial dental assessment by 1 year of age and preventive dental care to mitigate caries risk for this medically compromised patient population.<sup>23</sup>

In summary, a heightened awareness by health care providers that oral health and general health are not distinct entities is warranted. Awareness among health care providers of the importance of early and regular dental assessments for all children, but in particular for children with CHD, should be increased. The adoption of a collaborative team approach by health care providers can prevent dental disease and, thereby, reduce morbidity and mortality risks among children with CHD. Ultimately, it is in the best interests of the child that dental and non-dental health care providers work in a coordinated way to optimize the oral health and, thus, the systemic health of this at-risk patient population.

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