*Cardiol Young 2009; 19: 252–256*

ISSN 1047-9511
doi:10.1017/S1047951109003977
First published online 14 April 2009

*Original Article*

# The impact of oral health on the quality of life of young patients with congenital cardiac disease

Marcio A. da Fonseca,[1] Meredith Evans,[2] Douglas Teske,[3] Sarat Thikkurissy,[1] Homa Amini[1]

*[1]Division of Pediatric Dentistry, The Ohio State University College of Dentistry and Nationwide Children's Hospital, Columbus, Ohio; [2]Private Practice Pediatric Dentistry, Chicago, Illinois; [3]The Heart Center, Nationwide Children's Hospital, Columbus, Ohio, United States of America*

**Abstract** The purposes of our study were, first, to determine the prevalence of dental caries in young patients with congenital cardiac disease, second, to determine the effect of oral health in their quality of life, third, to examine parental knowledge about associations between oral health and cardiac health, and fourth, to examine parental perceptions regarding access to dental care. A standardized questionnaire was given to a convenience sample of parents of 43 children with cardiac disease and 43 healthy controls from 12 to 71 months of age. In every patient, we performed a dental examination. Descriptive statistics, the two-tailed t-test, and Fisher's exact test were used for statistical analysis. Of the children with cardiac disease, 17% had caries, compared to 13% of the control group. Almost half of those with cardiac disease had never seen a dentist, compared to 35% of the control subjects. Of the parents of those with cardiac disease, one-fifth did not know whether oral health was important for the heart, compared to one-tenth of controls. Insurance and access to care were not barriers to obtain dental treatment. Statistically significant differences were, first, parents of children with congenitally malformed hearts felt more guilt about their child's oral health than control parents ($p = 0.026$), second, they were more upset about the dental problems and/or treatments of their children ($p = 0.012$), and third, they thought that dental problems and/or dental treatment made their children more irritable ($p = 0.012$). Our findings indicate that it is of paramount importance that cardiologists and their associated staff educate patients and families about oral health and other issues associated with congenital cardiac disease.

Keywords: Dental caries; pediatric dentistry; pediatric cardiology

DESPITE INCREASING ADVANCES IN MODERN dentistry, dental caries continues to be the most common chronic childhood disease, with a higher prevalence than asthma, hay fever, and chronic bronchitis.[1] Early childhood caries is defined as the presence of one or more decayed, missing, or filled surface in any primary tooth in a child less than 6 years of age.[2] According to the United States National Center for Chronic Disease Prevention and Health Promotion, two-fifths of children aged from 2 to 11 years, and from 6 to 19 years, had caries in their primary and permanent teeth over the period from 1999 through 2002, respectively.[3] Unfortunately, children with early caries are more likely to develop new caries throughout their lifetime compared to those without it.[4,5] The highest risk for dental disease is seen in children from low-income or under-represented minority families, and in those with needs for special health care.[1] The American Heart Association recognizes that achieving and maintaining good oral health may reduce the incidence of some

Correspondence to: Marcio A. da Fonseca, DDS, MS, Nationwide Children's Hospital, Department of Dentistry, 700 Children's Dr., Columbus, OH 43205. Tel: (614) 722-5648; Fax: (614) 722-5671; E-mail: Marcio.DaFonseca@nationwidechildrens.org

Accepted for publication 3 February 2009

cardiac problems, such as infective endocarditis. Its guidelines published in 2007 recommend dental evaluations and treatment prior to cardiac valvar surgery, or repair of congenital defects, in order to decrease the risk of infective endocarditis.[6]

Children with congenital cardiac disease have a decreased quality of life compared to healthy children. They present with reduced physical, motor, cognitive, and emotional functioning, which causes a negative emotional impact on their parents.[7–10] Untreated dental caries also results in diminished quality of life. Its sequels, such as pain, infection, swelling, failure to thrive, and so on, increase medical expenditures due to visits to the emergency room and hospitalizations leading to loss of school and work days, thus affecting the familial levels of stress.[11–13]

While there have been multiple studies examining the health-related quality of life in children with congenital cardiac disease, as far as we are aware their oral health-related quality of life has not been evaluated. Studies of oral health-related quality of life in children that used parental/guardian proxy surveys have demonstrated both validity and reliability.[14–16] Patients with congenital cardiac disease are at high risk of developing dental caries at a young age, thus adding another burden to their quality of life. The aims of this study, therefore, were first to determine the prevalence of dental caries in young patients with congenital cardiac disease, second to determine the effect of oral health in their quality of life, third to examine parental knowledge about associations between oral health and cardiac health, and fourth to examine parental perceptions regarding access to dental care.

## Materials and methods

The study was approved by the Institutional Review Board of our hospital, and the confidentiality of participants was strictly protected. A convenience sample of 43 cardiac children and 43 healthy control subjects between 12 and 71 months of age, together with their parents, were recruited in the paediatric cardiology and primary care clinics, respectively. The patients presented a variety of congenital cardiac defects, albeit being free of other chronic diseases or syndromes. Specific data on the specific diagnosis and history of surgeries and interventional cardiac procedures were not collected. We selected the Early Childhood Oral Health Impact Scale as the tool for our study, since it has shown test-retest reliability and validity in measuring oral health-related quality of life in young children.[14] After signing an informed consent, the 13-item scale was completed by the parents or legal guardians of the children, along with 9 demographic questions regarding their perceptions about access to care and importance of oral health. This scale measures 6 domains pertaining to quality of life:

- Symptoms
- Function
- Psychological state
- Self-image/social interaction
- Parental distress
- Family function.

Responses were graded on a Likert scale from 1 to 6 for never, hardly ever, occasionally, often, very often, and don't know.

After completion of the survey, a brief clinical oral and dental examination was performed by the same paediatric dental resident using a light and a disposable mouth mirror in both recruiting clinics. A decayed, extracted, filled tooth score, which represents the burden of disease, was noted on a standardized sheet for each patient. The score is a sum of the number of decayed, extracted, filled teeth, with the maximum being 20 in patients with a complete primary dentition. Clinical findings were discussed with the patients and their legal guardians, and those diagnosed with dental needs were referred for care. Descriptive statistics were used to report the frequency of responses for the questions posed in the Early Childhood Oral Health Impact Scale. Fisher's exact test was used for categorical variables, while the deft score was analyzed using two-tailed t-test. The level of statistical significance was set at 0.05.

## Results

The mean age of the subjects was 3.02 years, with standard deviation of 1.32, for those with congenitally malformed hearts, and 2.73 years, with standard deviation of 1.38, for the control group. The overall mean decayed, extracted and filled teeth score for those with cardiac lesions was 1.03, with standard deviation of 1.85, and 1.23, with standard deviation of 2.54 for the control group. Of those with cardiac lesions, 17% had decay compared to 13% of the control group. The mean decayed, extracted and filled teeth score for children with caries was 2.97, with standard deviation of 2.06 for those with cardiac disease, and 4.04, with standard deviation of 3.43, for the control group, but the difference was not statistically significant ($p = 0.486$). There were no significant findings regarding the soft tissue examination in either group.

In regards to frequency of dental appointments, 48.8% of the control group saw a dentist every 6 months, compared to 38.1% of those with cardiac lesions ($p = 0.352$). Almost 35% of the control subjects had never seen a dentist, compared to

https://doi.org/10.1017/S1047951109003977 Published online by Cambridge University Press

Table 1. Reasons for not seeing a dentist.

| | Cardiac | Control |
|---|---|---|
| Too young | 6 | 9 |
| Too busy to make an appointment | 3 | 3 |
| Afraid because of the heart | 3 | 0 |
| No dentist will see child due to heart disease | 2 | 0 |
| No complaints of toothache | 1 | 1 |
| Child is too sick | 1 | 0 |
| No insurance | 1 | 2 |
| No dentist will see child due to age | 0 | 1 |
| No dentists available in my community | 0 | 0 |
| Teeth are not important | 0 | 0 |

47.6% of those with congenitally malformed hearts. No control subject had been to a dentist on an emergency basis, albeit that 7% of the children with malformed hearts had. The most common reason for not seeing a dentist was the parental assumption in both groups that the child was too young (Table 1). Of the parents of children with cardiac lesions, 3 had not taken their children to the dentist because of the cardiac condition, and 2 others reported they could not find a dentist who was willing to see them for the same reason. There was no statistically significant difference between the groups.

Of the children with cardiac disease, one-fifth brushed their teeth alone, while another fifth had the parents do it. In just over half, child and parent brushed together, while 4.6% did not brush at all. Almost nine-tenths of the control parents participated in toothbrushing, compared to three-quarters of the parents of children with cardiac lesions. Of the children with cardiac disease, nine-tenths brushed daily, 4.6% brushed a few times during the week, and 4.6% rarely did. There were no statistically significant differences between the groups regarding oral hygiene supervision and frequency.

Over 70% of the parents of the children with malformed hearts thought that oral health was important for the heart, while 7% responded negatively, and 21% did not know. Almost 75% of the control parents responded that oral health was important for the heart, 16.3% said it was not, and 9.3% did not know. These findings showed no statistically significant difference ($p = 0.313$). The majority of the children with malformed hearts received information on oral health from the paediatrician, cardiologist, or the dentist of the parents (Table 2). Of parents of children with congenital cardiac disease, 6 said that they had never been educated about it, compared to 11 control parents. Almost half of the parents of children with malformed hearts reported that their children required prophylaxis for infective endocarditis before an invasive dental procedure. Three-tenths said prophylaxis was not needed, and almost one-quarter did not know whether it was required.

Table 2. Sources of education on oral health.

| | Cardiac | Control |
|---|---|---|
| Paediatrician | 23 | 18 |
| Parents' dentist | 19 | 9 |
| Cardiologist | 17 | 0 |
| Child's dentist | 14 | 13 |
| Dental or hygienist student | 4 | 4 |
| Medical student | 0 | 1 |
| Nobody | 6 | 11 |

The scale responses were analyzed using descriptive statistics. Statistically significant differences were found in respect that parents of children with malformed hearts felt that their children were more irritable or frustrated because of dental problems and/or dental treatments compared to control parents ($p = 0.012$). These parents also reported feeling more upset about the dental problems of their children ($p = 0.012$); and felt more guilt because of the oral health of their children ($p = 0.026$).

## Discussion

In the United States of America, almost one-fifth of children aged between 2 and 4 years are afflicted by early childhood caries.[4,5] Our data revealed a similar percentage for our cohort of children with congenitally malformed hearts, reflecting the findings of most studies.[17–21] Even in European countries, where access to dental care is free and available, children with congenitally malformed hearts also had a higher rate of caries despite strong preventative efforts.[17,20] In fact, the score for decayed, extracted and filled teeth in our study is probably higher than what was found because no radiographs were exposed, possibly missing carious lesions on the surfaces between teeth. There were no significant differences, however, in the extent of caries between the two groups, which is in agreement with other studies.[22,23] Children with congenitally malformed hearts are more likely to experience dental caries than healthy children due to several factors. First, there is a high frequency of developmental defects in the enamel, which increases the susceptibility to caries.[18,22] Second, frequent vomiting occurs early in life due to nutritional problems.[17] Third, there is lack of oral hygiene following frequent ingestion of heavily sweetened medications and nutritional supplements.[24] Fourth, medication-induced xerostomia plays a role. Fifth, oral hygiene is difficult due to gingival hypertrophy in transplant recipients.[25] Sixth, low priority is given by families to oral care. Seventh,

https://doi.org/10.1017/S1047951109003977 Published online by Cambridge University Press

parental overindulgence is likely to result in sweet rewards, and finally, there is little knowledge of oral health.

Our data showed that children with congenitally malformed hearts had a reduced oral health-related quality of life in some specific domains, including family stress and psychological impact on the child. The statistically significant differences found between the groups were that the parents of the children with malformed hearts felt more guilt about the oral health of their children than control parents, were more upset about the dental problems and/or treatments, and considered that the dental problems and/or dental treatments made their child more irritable or frustrated. These findings may be due to several reasons. First, the presence of dental caries is a constant threat to the health of the child given its possible complications. Second, failure to prevent dental caries, thus adding to the health problems, is frustrating. Third, the use of general anaesthesia to treat extensive dental caries in children with malformed hearts, which is usually necessary, creates additional financial, emotional, and physical burden. Fourth, prevention of dental caries requires diligent oral hygiene and changing dietary habits which can be overwhelming for the families. It has previously been shown[18] that almost two-fifths of children with cardiac malformations but without medication intake were caries-free, compared to only one-tenth of those who took medication daily. Furthermore, a significant correlation between digoxin and dental caries has been observed.[17]

Interestingly, one-fifth of the parents of children with cardiac disease, compared to one-tenth of controls, were unsure of the relationship between oral and cardiac health, while almost one-quarter did not know about the need for prophylaxis against infective endocarditis. It has previously been shown[26] that, although half of the parents of children with cardiac disease were aware of the need for antibiotics before invasive dental procedures, most did not understand the reason why that was necessary. It has also been demonstrated[20] that parents of children with cardiac disease who had a dental home had a significantly better knowledge of antibiotic prophylaxis than those who were not established with a dentist, which is probably related to the dental professional stressing its importance at every appointment.

Almost half of the parents of the children with malformed hearts had never taken their child to the dentist, even though the majority reported that they had been educated about the importance of oral health. The most common reason for not having had a dental visit was the parental belief that the child was too young to go to the dentist (Table 1). Both the American Academy of Pediatric Dentistry and the American Academy of Pediatrics recommend that children have their first dental examination around 12 months of age, particularly those at high risk of caries.[27,28] A few parents did not take their child to the dentist because of the cardiac disease, a misconception that providers of healthcare must clarify with the families. Other studies also found a high percentage of children with malformed hearts who had never had a dental examination.[20–22] Supervision and frequency of toothbrushing were similar between the two groups regardless of the differences in dental visits, which was in contrast to some studies.[21,22] Others[18] have found that only two-fifths of children with malformed hearts had an adult supervising their oral hygiene, which was much lower than our figure of three-quarters.

The responses from both groups indicated few barriers to access to dental care. Most subjects reported seeing a dentist regularly, and very few complained of lack of dental insurance and/or inability to find a dentist who was willing to treat their child (Table 1). Many studies, however, have found significant barriers to dental care for children with special needs for health care.[29–31] The reason may be that the populations studied had other types of special needs.

Our study has its limitations. We recruited only English-speaking families due to the limited availability of interpreters. A radiographic examination was not done, which would have identified lesions not seen on a visual exam. Parental recall bias regarding dental care and/or dental pain may have also contributed to skewed answers. Responses from parents of very young children may have distorted the data due to their inability to communicate certain aspects of oral health-related quality of life. There was no discrimination between patients with malformed hearts who used oral medications and those who did not. A larger sample may have produced more statistically significant results.

The American Heart Association recognizes that untreated caries can become a severe threat to children with congenital cardiac disease, hence its recommendation for a dental examination and treatment prior to surgery.[6] Our study has confirmed that this population has poorer oral health than healthy children, which leads to a lower quality of life. One of the reasons for that is the inadequate counseling, monitoring, and professional and home care they receive. Given the high content of sucrose in some paediatric medications, particularly in the United States of America, cardiologists and their staff must counsel parents to brush the teeth of their children after their intake, and prescribe sugar-free drugs, pills or tablets whenever

possible. The relationship between oral and systemic health must be consistently reinforced to parents of children with congenital cardiac disease, as the most significant barrier to good oral health is often a lack of knowledge.

## References


1. Evans CA, Kleinman DV. The Surgeon General's report on America's oral health: opportunities for the dental profession. J Am Dent Assoc 2000; 131: 1721–1728.
2. American Academy of Pediatric Dentistry. Reference Manual. Definition of Early Childhood Caries (ECC). Pediatr Dent 2007/2008; 29: 13.
3. Beltrán-Aguilar ED, Barker LK, Canto MT, et al. Surveillance for dental caries, dental sealants, tooth retention, edentulism, and enamel fluorosis – United States, 1988–1994 and 1999–2002. US Centers for Disease Control and Prevention. MMWR Surveill Summ 2005; 54: 1–43.
4. Li Y, Wang W. Predicting caries in permanent teeth from caries in primary teeth: an eight-year cohort study. J Dent Res 2002; 81: 561–566.
5. O'Sullivan DM, Tinanoff N. The association of early dental caries patterns with caries incidence in preschool children. J Pub Health Dent 1996; 56: 81–83.
6. Wilson W, Taubert KA, Gewitz M, et al. Prevention of infective endocarditis. Guidelines from the American Heart Association. Circ 2007; 115: 1–19.
7. Varni J, Limbers CA, Burwinkle TM. Impaired health-related quality of life in children and adolescents with chronic conditions: a comparative analysis of 10 disease clusters and 33 disease categories/severities utilizing the PedsQL 4.0 generic core scales. Health Qual Life Outcome 2007; 5: 43–58.
8. Hovels-Gurich HH, Konrad K, Skorzenski D, et al. Long-term behavior and quality of life after corrective cardiac surgery in infancy for tetralogy of Fallot or ventricular septal defect. Pediatr Cardiol 2007; 28: 346–354.
9. Walker RE, Gauvreau K, Jenkins KJ. Health-related quality of life in children attending a cardiology clinic. Pediatr Cardiol 2004; 25: 40–48.
10. Mellander M, Berntsson L, Nilsson B. Quality of life in children with hypoplastic left heart syndrome. Acta Paediatr 2007; 96: 53–57.
11. Fleming P, Gregg TA, Saunders ID. Analysis of an emergency dental service provided at a children's hospital. Int J Paediatr Dent 1991; 1: 25–30.
12. Schwartz S. A one-year statistical analysis of dental emergencies in a pediatric hospital. J Can Dent Assoc 1994; 60: 959–962, 966–968.
13. Sheller B, Williams BJ, Lombardi SM. Diagnosis and treatment of dental caries-related emergencies in a children's hospital. Pediatr Dent 1997; 19: 470–475.
14. Pahel BT, Rozier RG, Slade GD. Parental perceptions of children's oral health: The Early Childhood Oral Health Impact Scale (ECOHIS). Health Qual Life Outcome 2007; 5: 6–17.
15. Filstrup SL, Briskie D, da Fonseca M, Lawrence L, Wandera A, Inglehart MR. Early childhood caries and quality of life: child and parent perspectives. Pediatr Dent 2003; 25: 431–440.
16. Rebok G, Riley A, Forrest C, et al. Elementary school-aged children's reports of their health: a congnitive interviewing study. Qual Life Res 2001; 10: 59–70.
17. Stecksen-Blicks C, Rydberg A, Nyman L, Asplund S, Svanberg C. Dental caries experience in children with congenital heart disease: a case-control study. Int J Paediatr Dent 2004; 14: 94–100.
18. Hallet KB, Radford DJ, Seow WK. Oral health of children with congenital cardiac diseases: a controlled study. Pediatr Dent 1992; 14: 224–230.
19. Pollard MA, Curzon MEJ. Dental health and salivary Streptococcus mutans levels in a group of children with heart defects. Int J Paediatr Dent 1992; 2: 81–85.
20. Balmer R, Bu'Lock FA. The experiences with oral health and dental prevention of children with congenital heart disease. Cardiol Young 2003; 13: 439–443.
21. Saunders CP, Roberts GJ. Dental attitudes, knowledge, and health practices of parents of children with congenital heart disease. Arch Dis Child 1997; 76: 539–540.
22. Franco E, Saunders CP, Roberts GJ, Suwanprasit A. Dental disease, caries-related microflora and salivary IgA of children with severe congenital cardiac disease: an epidemiological and oral microbial survey. Pediatr Dent 1996; 18: 228–235.
23. Tasioula V, Balmer R, Parsons J. Dental health and treatment in a group of children with congenital heart disease. Pediatr Dent 2008; 30: 323–328.
24. Bigeard L. The role of medication and sugars in pediatric dental patients. Dent Clin North Am 2000; 44: 443–456.
25. Al-Sarheed M, Angeletou A, Ashley PF, Lucas VS, Whitehead B, Roberts GJ. An investigation of the oral status and reported oral care of children with heart and heart-lung transplants. Int J Paediatr Dent 2000; 10: 298–305.
26. Cheuk DKL, Wong SMY, Choi YP, Chau AKT, Cheung YF. Parents' understanding of their child's congenital heart disease. Heart 2004; 90: 435–439.
27. American Academy of Pediatric Dentistry. Reference manual. Definition of dental home. Pediatr Dent 2007/2008; 29: 10.
28. American Academy of Pediatrics Section on Pediatric Dentistry. Oral health risk assessment timing and establishment of the dental home. Pediatrics 2003; 111: 1113–1116.
29. Shenkin JD, Davis MJ, Corbin SB. The oral health of special needs children: dentistry's challenge to provide care. J Dent Child 2001; 86: 201–205.
30. Halfon N, Inkelas M, Wood D. Nonfinancial barriers to care for children and youth. Ann Rev Pub Health 1995; 16: 447–472.
31. Newacheck PW, McManus M, Fox HB, Hung YY, Halfon N. Access to health care for children with special health care needs. Pediatrics 2000; 105: 760–766.