

ORAL HEALTH STATUS OF PAEDIATRIC CARDIAC PATIENTS: A CASE-CONTROL STUDY

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Abstract

Dental care in children with cardiac disease is an important consideration from the time the first tooth erupts because of the risk of infective endocarditis (IE). Transient bacteraemia occurs frequently during dental procedures with instrumentation or even after routine oral activities.

Objectives: To investigate the oral health of paediatric cardiac patients and the parental knowledge about their child's oral health and infective endocarditis and to compare it with age and gender-matched children without cardiac disease.

Materials and methods: A total of 66 children with heart diseases aged 2-12 years attending the paediatric cardiology clinic of the Tygerberg Hospital were examined for dental caries, developmental enamel defects, plaque and gingivitis. A case-matched control group of 66 children was also examined. The criteria used for dental examination were those of World Health Organization (WHO) Basic Oral health survey (1997). Parental oral health care and infective endocarditis knowledge was assessed by administering a structured questionnaire.

Results: No statistically significant differences were established in the study between the caries experience score for the two groups. However, the mean decayed component and total mean dmft and DMFT were slightly higher in the cardiac group, in both the primary and permanent dentitions. The prevalence of developmental dental anomalies was slightly higher in the cardiac group but not statistically significant. Gingival inflammation was significantly higher in the cardiac group as compared to the control group ($p = 0.04$). The parental knowledge of oral health care and infective endocarditis was not satisfactory in both groups.

Conclusion: As these children are "at risk" from dental disease, the primary focus should be on oral hygiene instructions, dietary counseling, instructions on fluoride use and the awareness of infective endocarditis.

Keywords: Cardiac disease; case-control study; oral health; parental knowledge; paediatric

Introduction

Oral health is a desirable component of child's general health maintenance. If a child's general health is compromised, care for his/her oral and dental health becomes an absolute necessity. Children with congenital heart defects occur approximately 8 in 1000 live births.¹ Children with heart

diseases require special dental care because of the risk of developing infective endocarditis (IE) which is a rare, but life threatening condition.² Despite all the advances in the health sciences, IE still has a high mortality and morbidity rate.³ Untreated dental decay in paediatric cardiac patients has a significant implication in the medical care of these patients, as it may develop into pulp infections which are associated with bacteraemia, endocarditis, and even brain abscesses.⁴⁻⁷

Studies have shown significant findings regarding the susceptibility to infective endocarditis and poor oral health, especially periodontal status, and certain dental procedures are risk factors in these patients.⁸ Dental extraction (50-100%), periodontal surgery (36-88%), scaling and root planing (8-80%), endodontics (0-54%), tooth brushing (0-26%), dental flossing (20-58%) and chewing (17-52%) may induce bacteraemia.⁹ The micro-organisms adhere to and colonize endocardial vegetation which is initially sterile and is composed of fibrin and platelets. The initial damage to endothelium is probably initiated by blood jet streams or by eddy currents caused by various congenital and acquired endocardial lesions.¹⁰

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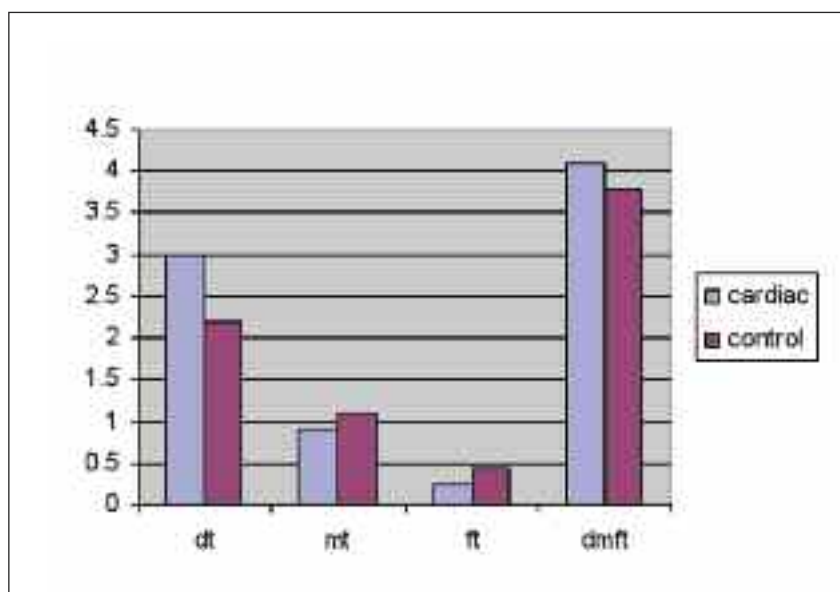


Figure 1: dt, mt, ft and dmft for the cardiac and control groups for the total sample.

In spite of being 'at risk', there is little data available on the oral health status, the parental knowledge and health care practices of paediatric cardiac patients. The study by Berger¹¹, Hallett et al¹² and Franco et al¹³ showed that the children with congenital heart disease suffered poorer oral health compared to the control group. In the African region there are only few prevalence studies on cardiovascular disease in children, and none on the oral health status and parental awareness of their child's oral health.^{14,15}

Therefore, the purpose of the present study was to investigate the oral health status of the paediatric cardiac patients, parental oral health care knowledge and infective endocarditis awareness among the parents of the cardiac and non-cardiac group.

Materials and Methods:

The sample was drawn from cardiac and non-cardiac paediatric patients attending the outpatient clinics at Tygerberg Hospital over a period of six months (March 2007 to August 2007). A structured, administered questionnaire for parents/caregivers knowledge and an oral examination of the children were used for data collection. A selective non-random sample of 132 children, 66 children with known cardiac diseases (study group) and 66 without cardiac disease (control group), 2-12 years of age were selected. The two groups were matched for age and gender. The medical diagnosis of the cardiac patients is given in Table 1. Children in the control group included those who were brought to the hospital for minor complaints such as cough,

flu, fever, gastroenteritis or traumatic injuries. Children, who were physically or intellectually compromised or with other serious medical diagnoses were excluded from the study.

The dental examination of the children was conducted using the World Health Organization's (WHO) diagnostic criteria as detailed in the guidelines of Basic Oral Health Surveys (1997).¹⁶ The tooth status i.e. decayed/missing/filled (dmft/DMFT) and developmental enamel defects were recorded. An epidemiological index of developmental defects of dental enamel was used for recording enamel defects.¹⁷ No radiographs were taken. Dental plaque was visually inspected on the labial surfaces of maxillary incisors by using the criteria recommended by Spitz et al.¹⁸ Gingivitis was recorded simply as healthy, inflamed or cyanosed. The examination was performed by a single examiner using standard protocol for all patients. The examiner was calibrated by an experienced paediatric dentist for the clinical examinations.

The data was tabulated on an excel spreadsheet and was analyzed using a commercially available statistical software package (SPSS 15.0, SPSS Inc.). The Mann-Whitney U test was employed to assess the significance of differences between the study and control groups for dt, mt, ft, dmft, DT, MT, FT and DMFT, and for plaque and gingivitis. Multiple regression analysis did not elicit any meaningful results.

The methodology and ethics of the study was approved by the Senate Research Committee together with the Human Subjects Ethics Committee of the University of the Western Cape.

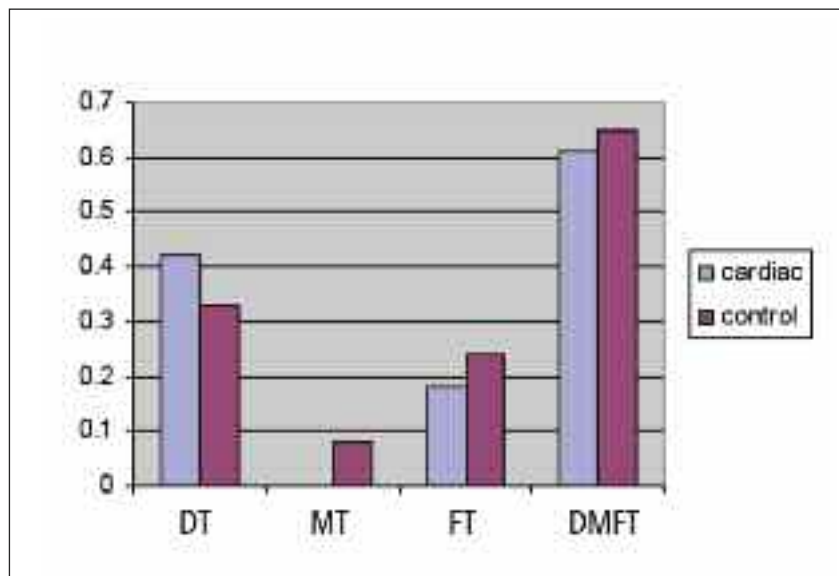


Figure 2: DT, MT, FT and DMFT for the cardiac and control groups for the total sample.

Results

A total number of 132 patients, 66 with cardiac disease (study group) and 66 without cardiac disease (control group) with a mean age of 6.5 ± 3.8 were examined for the study. Of the sixty-six, 32 (48.5%) subjects were male and 34 (51.5%) subjects were female in both the cardiac and control groups. Table 2 shows differences in the oral health status of cardiac and control groups.

Dental caries

The mean number of decayed, missing and filled teeth in the primary dentition (dmft) was slightly higher in the cardiac group compared with the control group (4.1 vs. 3.8, $p = 0.87$), but this difference was not statistically significant. Similarly, in the permanent dentition, no significant differences were obtained in the mean DMFT between the cardiac and control groups (0.61 vs. 0.65, $p = 0.72$).

Developmental enamel defects:

In the cardiac group, there were 8 (12.1%) patients with at least one developmental enamel defect of the primary teeth as compared with only 3 (4.5%) patients in the control group. On the other hand, the permanent dentition in the cardiac group had 4 (6.1%) cases as compared to 3 (4.5%) in the control group. These results were not statistically significant.

Plaque and gingivitis:

Although there was a higher mean plaque score in the cardiac group compared with the control (mean value= 63.6% vs. 45.5%, $p = 0.32$), the difference was not statistically significant. The gingival inflammation was significantly higher

in the cardiac group (25.8% vs. 10.6%, $p = 0.04$) as compared to the control group. None of the patients presented with any signs of cyanosis of the oral soft tissues.

Parental oral health care knowledge:

As shown in Table 3, in the cardiac group, 60% of the parents understood the causes of dental plaque as compared to only 40% in the control group. In the cardiac group, more parents (56%) were aware of the beneficial effects of the fluoride as compared to the control (33%).

Forty eight percent of the cardiac group compared to 42% of the control group was more regularly brushing their teeth (twice a day, morning and evening). Fifty-one (66.7%) patients in the cardiac group had not visited the dentist in the last 12 months as compared to 52 (71.2%) in the control group.

Infective endocarditis:

In response to the question: do you think that the condition of the child's mouth could affect his/her heart, 51.5% of the parents/caregivers in cardiac group responded 'yes' as compared to 39.4% in the control group. Twenty percent of the parents in the cardiac group were aware of the infective endocarditis as compared to only 9% in the control group. Nine percent of the parents in the cardiac group claimed that their children were given antibiotics before dental treatment (Table 3).

Discussion:

No significant differences were established between the oral health status of the children with cardiac disease and the closely matched control group. The cardiac group compared to

Table 1
Medical diagnosis of the examined cardiac patients

Diagnosis	Number (n)	Percentage
Congenital heart diseases		
Ventricular septal defect (VSD)	24	36.4%
Atrial ventricular septal defect (AVSD)	8	12.1%
Atrial septal defect (ASD)	7	10.6%
Patent ductus arteriosus	3	4.5%
Tetralogy of Fallot	3	4.5%
Mitral value prolapse	2	3.0%
Congenital heart block	1	1.5%
Coarcatation of aorta	1	1.5%
Pulmonary stenosis	1	1.5%
Aortic stenosis	1	1.5%
Truncus arteriosus	1	1.5%
Acquired heart diseases		
Rheumatic heart disease	11	16.6%
Kawasaki disease	3	4.5%
Total	66	100.0%

control group generally had a higher decay component (dt =3.0 vs. 2.2 and DT = 0.42 vs. 0.33) and a lower missing and filled component (mt= 0.91 vs. 1.1 MT= 0.00 vs. 0.08, ft= 0.24 vs. 0.44 and FT=0.18 vs. 0.24), as shown in figure 1 & 2. These results were not statistically significant. The higher mean decay and lower missing and filled component show decreased dental intervention in the cardiac group as compared to the control group.

The results of our study are in line with the study by Franco et al.¹³ However, a study by Pollard and Curzon¹⁹ found a statistically significant higher dmft in 5-9 years old cardiac children as compared to controls. Another study by Hallet et al¹² also found significantly higher dmft in the cardiac group as compared to the control group.

The reason for this lack of establishment of difference in the caries score between the two groups can be elaborated in the light of a survey conducted by van Wyk and van Wyk.²⁰ According to them, more than 80% of caries in the African children is untreated. Therefore the difference in oral health status of two groups might have been better reflected with a larger study sample. The high unmet dental needs are not only present in the African region but studies from developed countries such as USA also reported similar results.^{21, 22}

Although there was no significant difference in the number of developmental enamel defects in the two groups, these defects were, however, more pronounced in the primary dentition as compared to the permanent (12.1% vs. 6.1% in cardiac group). Most of these defects were white opacities. Radford²³ and Jensen²⁴ have shown that the patients with congenital heart defects have increased prevalence of developmental defects. Hallet et al¹² also showed similar results. However, in our study, no such differences were established. In contrast to the above, Franco et al¹³ found a significantly higher number of developmental enamel defects in the control group as compared to the cardiac group.

In the present study, the cardiac group generally had higher levels of plaque when compared to control group. But this difference was not statistically significant. The cardiac group had significantly higher gingivitis as compared to control group. The results are similar to the study by Hobson and Slattery²⁵, who found out that almost 15% of the subjects in the cardiac group had well established periodontal disease.

Studies showed that children with congenital heart defects have more severe gingival inflammation than the normal population.²⁶ Specific reasons for this are not clear but suggested reasons include a low priority to dental care by

Table 2
Oral health status of cardiac and control patients

	Cardiac n=66	Control n=66	P value
dmft (2-12 years old)	4.17 ± 4.45	3.85 ± 4.13	.877
DMFT (5-12 years old)	.61 ± 1.33	.65 ± 1.34	.721
No. of caries free children			
Developmental enamel defects (primary dentition)	8(12.1%)	3(4.5%)	ns
Developmental enamel defects (permanent dentition)	4 (6.1%)	3(4.5%)	ns
Plaque	42 (63.6%)	30 (45.5%)	.32
Gingivitis	17 (25.8%)	7 (10.6%)	.04

parents/caregivers of these children. They also harbored specific HACEK microbes (*Haemophilus spp*, *Actinobacillus actinomycetemcomitans spp*, *Cardiobacterium hominis*, *Eikenella corrodens* and *Kingella spp*) especially, *Eikenella corrodens (E.c.)* and *Actinobacillus actinomycetemcomitans (A.a.)* within the gingival crevice to a greater extent than their normal counterparts.

The results of the study showed a low level of oral hygiene awareness among parents/caregivers and children in the cardiac group as compared to controls. Saunders and Roberts²⁷ also found poor oral health practices in the cardiac group when compared with the control group. The reason most often cited in the literature is a lack of recognition of their child's need for dental services. The child's cardiac disease is always given priority by the parent and the cardiologist. As a result, the equally important oral health care needs are overlooked.

In the present study no statistically significant differences were found in regular brushing habits, between the cardiac and control group. This is in contrast to the findings of the Franco et al,¹³ who found out that only 21% of the children in the cardiac group were regularly brushing as compared to 73% in the control group. Silva et al²⁸ showed that many parents/patients lacked the proper knowledge required to maintain the optimal dental health of the child. On the other hand, several parents who were aware of the implications of negligence still did not emphasize its importance to their children. The study by Grahn et al²⁹ found that the attitude of the parents whose children receive dental services differed; parents of healthy children had a much better perception than those of children with cardiac disease. These studies indicate an inadequate parental education regarding the preventive health care needs of children with heart disease.

The result of our study also showed that the parents of the cardiac children are more aware of the infective endocarditis

than the general population (20% in study group vs. 9% in the controls). Considering the adverse effects that can occur because of endocarditis, this level of awareness is very low. The study conducted by Silva et al²⁸ found similar results, a small percentage (9.6%) of "at risk" patients were aware of the term infective endocarditis. However, the study by Cetta et al³⁰ in United States showed good parental awareness - 62% of the parents were aware of endocarditis and 56% parents knew that their children need antibiotics before dental treatment is carried out.

These findings suggest that most parents lack proper motivation to encourage good dental health in their children. The major barriers for this attitude can be cost, insurance policies, family problems fear/distrust of dentist and the priority given to the cardiac condition over the other aspects of health. There is a need for an emphasis on parental counseling regarding preventive health care measures, adequate dental care education, periodic screening, prompt diagnosis and early treatment in the paediatric cardiac patients.

The most recent guidelines by AHA (Wilson et al)³ and National Institute for Health and Clinical Excellence (NICE)³¹ recommend that there is no need for prophylactic antibiotics as a preventive measure in most of the cases where earlier antibiotics were considered compulsory, such as mitral valve prolapse, rheumatic heart disease, bicuspid heart disease, calcified aortic stenosis, congenital heart conditions such as ventricular septal defect and hypertrophic cardiomyopathy. The AHA guidelines emphasize that 'maintaining optimal oral health and practicing daily oral hygiene are more important in reducing the risk of IE than taking preventive antibiotics before a dental visit'.

The focus should be on awareness and prevention of the dental disease. The first dental visit of every child as recommended by the American Academy of Paediatric

Table 3
Preventive dental health and endocarditis knowledge of cardiac and control groups

Question	Cardiac n=66	Control n=66
1. What are the causes of dental plaque?	40 (60.6%)	27 (40.9%)
2. Are you aware of the beneficial effects of fluoride?	37 (56.1%)	22 (33.3%)
3. How many times are you brushing your teeth? (Regularly brushing- twice a day-morning & evening)	32 (48%)	28 (42.4%)
4. Have you taken your child to a dentist in the last 12 months?	44 (66.7%)	47(71.2%)
5. Do you think that the condition of a child's mouth can affect his/her heart?	34 (51.5%)	26 (39.4%)
6. Do you know what is bacterial endocarditis?	13 (19.7%)	6(9.1%)
7. Do you know that your child needs medication before the dental work is performed?	6 (9.1)%	---

dentistry²² should be no longer than six months after eruption of the first tooth. This should be observed more strongly in cases of medically compromised children such as cardiac. There should be closer co-operation between paediatric cardiologists and paediatric dentists. Dental screening by the oral hygienist or dentist in the cardiac clinic, distribution of preventive health care literature, early referral and prompt treatment of the children with the signs of decay can help improve oral health status of the paediatric cardiac patients.

Conclusion

No significant differences were established between the oral health status of the paediatric cardiac patients and the closely matched control children. Although the parents of the cardiac children showed more awareness about infective endocarditis and were more involved in the oral health practice of their children, but it was not statistically significant. There is a need to raise awareness about the preventive dental health care measures.

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