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The oral health of children considered very high risk for infective endocarditis

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Background. Children with previous experience of infective endocarditis or with prosthetic heart valve are considered at very high risk for infective endocarditis.

Aim. The aim of this study was to compare the dental health of a group of these children with a group of healthy controls and to determine parental awareness of the importance of good oral health.

Design. Oral examination was carried out in 28 children with previous infective endocarditis or a prosthetic heart valve to assess oral health. Findings were compared to a healthy control group of 28. Questionnaires were distributed to the parents to assess awareness of oral health.

Results. There was no significant difference in DMFT scores of study and control group (2.43 +/- 3.72 and 1.36 +/- 2.5 respectively) or in DMFT scores of study and control group (1.5 +/- 1.73 and 1.15 +/- 1.42 respectively), 36% of the study group had untreated caries. Parental knowledge of the link between oral health and infective endocarditis was excellent.

Conclusions. There were no significant differences between the oral health of cardiac children and healthy children although the dmft and DMFT scores of the study group were high. Of concern was the proportion of children with untreated caries in spite of good dental awareness and attendance.

Introduction

Infective endocarditis (IE) is a condition in which there is infection of the endocardial surface of the heart. It has a reported incidence in the UK of 20 cases per million per year and is associated with high morbidity and mortality with about 20% of cases being fatal[1].

Children with congenital heart disease (CHD) are predisposed to IE. Several guidelines have existed which have identified specific underlying cardiac conditions that placed children at increased risk of IE[2–4]. Although there were subtle differences between them, all agreed that children with a history of IE and children with prosthetic heart valves should be considered a special or very high risk category. This is because of both increased likelihood of developing IE (in cases with a positive previous history) and because the consequences of IE were even more severe (in cases with prosthetic heart valves).

In practical terms this has translated into a more aggressive antibiotic regime for these patients for prophylaxis against IE. Recent guidelines developed and released by the National Institute for Health and Clinical Excellence[5], however, have determined that antibiotic prophylaxis is no longer required for dental work. This is because of the lack of evidence for its effectiveness, especially given a patient's exposure to everyday oral bacteraemia, and the possibility that it may actually do more harm than good. Very high risk category has been removed and these conditions along with a number of other cardiac conditions are simply all considered increased risk.

Given that these specific conditions have previously been singled out as very high risk and continue to have one of the highest risks for IE, it could be expected that these children would be high priority for dental care and, as a consequence, have low levels of dental disease. No specific studies have been published on this group although there has been some research examining oral health in

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relation to severity of cardiac defects. Berger[6] for instance found that children with cyanotic disease had more disease and more untreated disease than children with acyanotic cardiac disease. Stecksen-Blicks *et al.*[7] found higher levels of oral disease in children whose cardiac condition was defined as complex compared to healthy controls.

Aims

The aim of this project was to examine the dental health of children previously considered to be at very high risk (i.e., children with prosthetic heart valves or previous IE) for IE and compare them with healthy controls.

Methods

Control and study groups were selected from children who attended the outpatient clinic of the Paediatric Cardiac Department at Leeds General Infirmary (L.G.I.), UK. Ethical approval was obtained from Harrogate Research Ethics Committee.

The inclusion criteria for the study group were:

1. Patients diagnosed as having had an episode of IE before the age of 18 years.
2. Patients with a prosthetic heart valve placed before 18 years old.

The vast majority of the control group included children who attended the outpatient cardiac clinic for the first time and were diagnosed healthy without any structural heart defect. The rest of the control group comprised healthy children who were regularly followed up by the cardiology team due to family heart problems such as cardiomyopathy. Children were excluded from the study if there was co-morbidity.

Parents and children were approached during the children's regular appointments at the outpatient cardiac clinic. Written consent was obtained from all the parents of the children who were examined as well as from the children who were older than 5 years. All participants were examined by a single examiner who had been trained in caries diagnosis according to BASCD criteria. Participants were examined in a chair in an upright position. Only visual diagnosis was employed using a dental mirror which incorporated an LED light Mirrorlite by Defend, Carl Parker Associates (275 Oser Ave, Happauge, New York 11788-3637, USA). The teeth were not brushed prior to the examination although cotton wool rolls were used to remove any debris or moisture which may have hindered direct view of the teeth.

Decayed, missing and filled teeth were recorded for primary (dmft) and permanent (DMFT) teeth of children for both study and control group. In order to assess the intra-examiner reproducibility 10% of the children examined were re-examined by the investigator during their recall appointments which yielded a kappa score of 0.86.

Finally a short questionnaire was carried out. The parents were asked if their child was registered with a dentist and (for the study group) if they were aware that bad teeth could cause heart problems in their child.

All data was entered into the SPSS 15.0 for Windows statistical software for data analysis. A nonpaired comparison of the data was made using the 95% confidence interval of the difference of the means dmft and DMFT between the two groups.

Results

A total of 62 children were examined. No families refused to participate. Four patients were excluded because of co-morbidity conditions whilst two were excluded because they did not fulfil the age criteria. Finally a total of 56 children were included in the study; 28 in the control group and 28 in the study group.

The ages of the participants ranged from 3 to 18 for the study group and 3–16 for the control group. The mean age of the children was 9.11 (±4.49) in the study group and 8.61 (±3.97) in the control group. There was no statistically significant difference in the mean age between the two groups. The study group consisted of 12 patients that had previously had an episode of IE, 13 patients that had a prosthetic heart valve and three patients that had both.

A total of 21 in the study group and 22 in the control group had primary teeth. The dmft of these groups were 2.43 (±3.72) and 1.36 (±2.5) respectively. Although there seems a large difference in these two values, this difference was not shown to be statistically significant. Table 1 shows dmft for each group broken down into its components. There was a much higher number of missing teeth in the study group; however, the difference again did not reach statistical significance.

A total of 20 in the study group and 20 in the control group had permanent teeth. The DMFT of these groups were 1.5 (±1.73) and 1.15 (±1.42) respectively. The difference was not shown to be statistically significant. Table 2 shows DMFT for each group broken down into its components.

Table 3 gives a summary of the care index for each of the groups. This is a measure of the restorative care of those who have suffered disease. Significantly more primary teeth had been restored in control group than in the study group. No statistical difference was demonstrated between the restorative care for permanent teeth. Overall 36% of the study group and 50% of the control group had untreated decay.

There were significantly more teeth fissure sealed in the study group. There was however no difference in the number of children in each group who had at least one fissure sealant. This information is shown in Table 4.

All parents of children in the study group were aware of the link between oral health and IE risk in their children. All but one claimed to be regular attenders at a family dentist.

Discussion

Paediatric Cardiology at Leeds General Infirmary is a tertiary referral centre covering a child population of approximately one million[8]. In spite of this the numbers in this study were low which reflected the rarity of the conditions under investigation and the fact that many cases were reviewed in peripheral clinics which were not part of the study. Although the low numbers hinders the ability to draw valid comparative conclusions, the

Table 1. Mean dt, mt, ft, dmft in primary teeth in the study and control groups.

	Study group (*n* = 21)	Control group (*n* = 22)	Difference in means (95% CI)
Age range (years)	3–11	3–12	
Mean age (±SD)	7.00 (±2.84)	7.09 (±2.9)	−1.68 to 1.87
Mean dt (±SD)	1.52 (±3.06)	0.64 (±1.09)	−2.29 to 0.51
Mean mt (±SD)	0.62 (±1.36)	0.05 (±0.21)	−1.20 to 0.02
Mean ft (±SD)	0.29 (±0.78)	0.68 (±1.55)	−0.37 to 1.16
Mean dmft (±SD)	2.43 (±3.72)	1.36 (±2.50)	−0.37 to 0.90

n, number of subjects; 95% CI, 95% confidence interval; SD, standard deviation; dt, decayed primary teeth; mt, missing primary teeth; ft, filled primary teeth; dmft, decayed, missing, filled primary teeth.

Table 2. Mean DT, MT, FT, DMFT in permanent teeth in the study and control groups.

	Study group (*n* = 20)	Control group (*n* = 20)	Difference in means (95% CI)
Age range (years)	6–18	5–16	
Mean age (±SD)	11.25 (±3.38)	10.35 (±3.26)	−3.02 to 1.22
Mean DT (±SD)	0.85 (±0.99)	0.45 (±0.99)	−0.24 to 1.04
Mean MT (±SD)	0.20 (±0.89)	0.05 (±0.22)	−0.27 to 0.57
Mean FT (±SD)	0.45 (±0.94)	0.65 (±0.99)	−0.87 to 0.47
Mean DMFT (±SD)	1.50 (±1.73)	1.15 (±1.42)	−0.66 to 1.36

n, number of subjects; 95% CI, 95% confidence interval; SD, standard deviation; DT, decayed permanent teeth; MT, missing permanent teeth; FT, filled permanent teeth; DMFT, decayed, missing, filled permanent teeth.

Table 3. Care index for the primary and permanent dentition of study and control groups.

	Study group		Control group		
Dentition	*n*	Care Index (%)	*n*	Care Index (%)	Difference (95% CI)
Primary	21	11.9	22	50	–0.562 to –0.177*
Permanent	20	56.2	20	30	–0.0008 to 0.487

n, number of subjects; 95% CI, 95% confidence interval.
*Statistically significant.

study revealed some significant aspects of the dental care of the study group which are worth pursuing.

In both primary and permanent dentitions there was a tendency towards higher levels of dental disease which was not statistically significant. Previous studies have reported different results when comparing oral health in children with CHD against healthy controls[6,7,9–17] although a number do report higher oral disease levels in children with CHD[6,7,13,15,17]. A consistent finding, however, has been the high levels of untreated disease and this is also reflected in this study[6,7,9,12–15].

Deprivation categories were not recorded mainly because the low numbers in the groups made these scores unreliable. It is acknowledged that socioeconomic status is linked to caries levels and the possibility that it was a confounding factor in the results of this study cannot be totally eliminated. The inclusion criteria for the medical background of the high risk study group are not, however, linked to socio economic status so it could be anticipated that this group was representative – from a socio economic perspective – of the general population. In addition, the fact that no significant differences in caries levels were found between the two groups suggests that the impact of socioeconomic factors was minimal.

A further limitation of the study was that it was not possible to separate caries incidence in individuals in relation to their acute cardiac episode (i.e., the fitting of a prosthetic heart valve or the occurrence of IE). It is only after this episode that children would move into a very high risk category. It may be that they were always high risk for dental caries (it could be argued that this is the reason that the IE group contracted the disease in the first place) and that disease seen in the study reflected disease experience prior to the acute cardiac episode. Even so it would be expected that this episode would have crystallised the need for vigorous restorative and preventive care in the minds of both parents and professionals.

The care index in the primary dentition was only 11.9% in the study group and was significantly lower than in the control group. Care index is a measure of the restorative care received and this difference is likely to reflect more radical treatment planning for primary teeth in the study group. Pulp treatment of primary teeth, for instance, is contraindicated in children with cardiac defects[18]. It is therefore likely that far more extractions of decayed primary teeth would be carried out in the study group compared to a similar healthy population. This is shown in Table 1 which shows relatively higher numbers of missing teeth in the study group. However even in the study group untreated decay makes up by far the highest proportion of the dmft value.

The care index of the permanent dentition was much better at 56.2%. In spite of this it should still be noted that about 27% of decayed permanent teeth in this very high risk group were untreated. Overall 36% of

Table 4. Fissure sealants in the study and control groups.

	Study group *n* = 20	Control group *n* = 19	Difference in means (95% CI)
Mean number of teeth with fissure sealants (±SD)	2.30 (±4.635)	0.05 (±0.229)	0.089 to 4.406*
Number of children with at least one fissure sealant	6	1	–0.0004 to 0.47

n, number of subjects; SD, standard deviation.
*Statistically significant.

the children in the study group had untreated decay which is an obvious cause for concern. This was in spite of high awareness of dental disease and high attendance rates.

There are several factors that may have contributed to the findings of untreated decay in this high risk group especially considering reported attendance rates. There may have been some bias in the answers of parents who – given some knowledge of the risks of poor oral health – may have been giving the response that they thought was wanted. Assuming, however, that the answers were valid the question of untreated disease needs to be addressed.

There is no doubt that in the UK there is a reluctance to treat permanent and primary teeth in children. The most recent BASCD studies indicate that only 11% of decayed primary teeth in 5-year-olds[19] and 41% of decayed permanent teeth in 12-year-olds[20] are restored in spite of 70% of children attending a dentist on a regular basis[21]. Possible barriers to care are training[22], philosophical[23], and economical[24]. This reluctance to treat dental disease may be compounded in children who are medically compromised and, for whom, primary care practitioners may feel inadequately trained[22]. Certainly children who have had multiple medical interventions may become sensitised to treatment making it more difficult for them to have dental interventions[25]. The traditional barriers to care based on poor access because medically compromised children have dental health as a low priority (in the face of other chronic illness demands) does not seem to apply in this case as parents had high awareness and dental attendance. In any case, it is interesting to note that the pattern of care in this very high risk group seems to be simply an extension of the pattern of care delivered to all children in the UK in general.

Although the number of teeth fissure sealed in the study group was significantly higher than in the control group the actual number of children in whom fissure sealants were present was still relatively low. Given the medical history and dental attendance record one would have hoped that all children in the study group would have received fissure sealants. The results are consistent with previous studies which have demonstrated low preventive treatment in general and low levels of fissure sealants in particular in children with CHD[9,14].

Of note is that none of these children were under the regular care of a specialist in paediatric dentistry. Given the small numbers and the degree of risk it would seem sensible to recommend that these children receive all dental care in a specialist setting or at the very least have a specialist paediatric dentist over seeing their care. More research is required to clarify further the disease levels and barriers to care in this particular population. The rarity of the conditions suggests that any further research would need to be multi-centred.

Conclusions

This study did not demonstrate a significant difference in the dental health of children previously categorised as very high risk for IE. There was, however, a tendency to increased disease in the study group. A significant proportion of the study group had untreated decay in spite of high parental awareness and dental attendance rates.

What this paper adds

- This is the only published research paper to examine dental health in this very high risk population.
- It shows levels of dental disease in this population which are higher than optimum given their medical background and with a tendency to being higher than healthy controls.
- A high proportion of dental disease in this population was untreated.

Why this paper is important to paediatric dentists

- Paediatric dentists should be very closely involved in the dental care for this small but high risk population. Regular dental attendance and high parental awareness for these children does not necessarily mean that dental health will be at optimum levels.

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