Salivary Sialic Acid Levels and Dental Health In Children with Congenital Heart Disease

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Congenital cardiac disease is one of the most common developmental anomalies in children. Higher caries prevalence and gingivitis compared to healthy children have been shown in children with congenital heart disease which has a significant implication in the medical care of these patients associated with bacteraemia and endocarditis. Sialic acids being terminal sugar components and marker of chronic inflammatory response are found to be present at higher levels in children with poor oral health status. So the present study aimed to evaluate the oral health status and salivary sialic acid levels among the children with congenital heart disease and normal healthy siblings. A total of 71 children with heart diseases aged 6-10 years attending various heart institutes were examined for oral hygiene status, gingival status and dental caries status by using modified WHO oral assessment form. A case-matched control group of 50 children were also examined. Salivary flow rate, pH and sialic acid levels were measured after saliva collection. The results were subjected to Unpaired t test and Pearson's Correlation Coefficient Test.

The salivary pH, salivary flow rate, dental caries status, oral hygiene and the gingival status were significantly compromised with a positive correlation with the sialic acid levels in saliva, leading to increased treatment needs in the study group. Therefore the amount of sialic acid in the saliva can be a useful index of the severity of oral disease.

Keywords: *Congenital heart disease, sialic acid, oral health, children.*

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INTRODUCTION

Congenital cardiac disease is one of the most common developmental anomalies in children with the prevalence ranging from 3.7 to 17.5 *per* 1000 live births.[1]

Higher caries prevalence and untreated caries compared to healthy children have been shown in children with congenital heart disease in the past[2] which has a significant implication in the medical care of these patients associated with bacteremia and endocarditis.[3]

Many of these children have difficulties with nutrition during their first year of life. Parents usually pamper them with sweets because of their compromised condition and also feed them with frequent meals to compensate for emesis which is a commonly presenting condition in CHD children. In addition, many medications for CHD containing sucrose together with diuretics are taken that leads to xerostomia.[4]

The increased consumption of carbohydrates through frequent dietary intake and sweets would lead to increased levels of sialic acids in the body since they are the terminal sugar components of the oligosaccharide chains of glycoproteins and glycolipids.[5]

Sialic acid has been recognized to be involved in the regulation of biological phenomena such as functional stability, survival of glycoproteins in blood circulation and cell-to-matrix interactions. Serum sialic acid predicts coronary heart disease, stroke mortality and reflects the existence or activity of an atherosclerotic process. Similarly, it is hypothesized to play an important role in indicating the tissue damage caused by oral disease, the severity is indicated by estimation of sialic acid levels in saliva. Thus, serum and salivary sialic acid levels indicate the oxidative stress posed to the body.[6,7]

Since there is paucity of studies on salivary sialic acid levels in children with congenital heart disease, oral health status and salivary sialic acid levels were evaluated in the present study.

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MATERIALS AND METHOD

Seventy-one children with congenital heart disease between the age group of 6–10 years of both genders attending various heart institutes for the treatment of heart disease were part of the study group and 50 healthy siblings of the same age group were taken as control group. The children with congenital heart disease were examined at the hospital, seated on an ordinary chair in coachman position, under natural light using sterile portable equipments which included mouth mirror, explorer and cotton pellets.

Oral hygiene status was evaluated using Turesky-Gilmore-Glickman modification of Quigley-Hein plaque index (1970).[8] The prevalence and severity of gingivitis was measured using MGI.[8] Dental caries status and treatment needs were assessed according to WHO oral assessment form.[9] Salivary flow rate was calculated as the volume of saliva collected ml/min, salivary pH using a pH indicating strips (Merck specialities private limited) and salivary sialic acid levels by the method of Winzler *et al*[10] were estimated. The results were statistically analysed using Unpaired t test and Pearson's correlation coefficient test.

RESULTS

Oral hygiene status in cardiac children were poor as compared to their normal healthy siblings with the mean Turesky-Gilmore-Glickman modification of Quigley Hein Plaque Index value of 2.65 and 2.12 respectively and the difference was statistically highly significant (p=0.001 vhs). The modified gingival index in the CHD children showed a mean score of 2.81, which was higher than the healthy siblings showing a mean score of 2.22 and the difference was statistically very highly significant (p=.0001), depicting an increase of gingival inflammation in the CHD group. The dental caries experience in children with congenital heart disease was higher as compared to their healthy siblings with the mean dental caries status value of 7.15 in CHD children and 6.7 in their normal healthy siblings but the difference was stastically not significant. (p=0.066 ns) The salivary pH in children with congenital heart disease showed a mean value of 6.32 and, that of the healthy siblings was 6.08 , the difference of which was statistically highly significant (p=0.009 hs).

The mean value of salivary flow rate in children with congenital heart disease was 0.93 ml/ min where as in healthy siblings the mean value of salivary flow rate was 1.19 ml/min. Even though the values indicate that salivary flow rate was in normal range, difference between them was stastically very highly significant.(p = 0.001 vhs) The salivary sialic acid levels in the control group had a mean of 2.4mg /dl, where as a mean of 9.98mg/dl was recorded in the experimental group. There was a statistically very highly significant difference (p = 0.001) showing that the sialic acid level of saliva in the CHD group was increased (Tables 1, 4, 5).

The treatment needs among the CHD children was very high with 70.4% of CHD children requiring restorations, 28.2% requiring pulp therapy and 25.4% requiring extraction. (Tables 2 and 6)

Modified Quigley Hein's plaque index, modified gingival index and salivary sialic acid levels were negatively correlated to salivary pH and flow rate which indicated that there is inverse relationship between them. Plaque index, modified gingival index scores, and dental caries incidence were found to increase with the increase in salivary sialic acid levels. (Table 3)

Table 1. Comparison of oral hygiene status, gingival status, dental caries status, Salivary pH, salivary flow rate and salivary sialic acid levels among CHD and healthy children

	Groups	N	Mean scores	Std Deviation(±)	p value
Modified Quigley Hein Plaque Index	Study	71	2.657	0.3986	p<0.001 vhs
	Control	50	2.12	0.2539	
Modified gingival Index	Study	71	2.8189	0.53652	p<0.001 vhs
	Control	50	2.22580	0.31564	
Dental caries status	Study	71	7.1549	1.40049	p>0.05ns
	Control	50	6.7000	1.21638	
Salivary pH	Study	71	6.3239	0.58002	p <0.01hs
	Control	50	6.0800	0.35514	
Salivary flow rate(ml/min)	Study	71	0.9386	0.27362	p<0.001 vhs
	Control	50	1.1960	0.22403	
Salivary sialic acid levels(mg/dl)	Study	71	9.9886	4.10911	p<0.001 vhs
	Control	50	2.4082	1.37754	

Table 2. Comparison of treatment needs among CHD and

Treatment needs	CHD children n= 71	Healthy children n=50
Restoration	70.4%	56%
Pulp therapy	28.2%	18%
Extraction	25.4%	22%

Table 3. Correlation(r) between various parameters used in assessment of oral health status in CHD children

Parameters	Flow rate (ml/min)	Sialic acid levels (mg/dl)	Quigley hein plaque index	Dental caries status	Modified gingival index
Salivary pH	0.296	-0.145	-0.137	-0.406	-0.072
Salivary flow rate(ml/min)	–	-0.038	-0.274	-0.206	-0.165
Sialic acid level(mg/dl)	–	–	0.05	0.244	0.151r-

Pearson's corelation coefficient

DISCUSSION

Congenital cardiac disease refers to the structural or functional heart diseases present at birth. It is a challenge for dentists to provide these pediatric patients, a dental service that is adjusted to their needs whose medical health can be jeopardized as a result of poor dental health.[11]

In the current study, as well as in few earlier studies,[3,13] the children with CHD have exhibited poor oral hygiene and higher MGI scores. This could be due to the increased tooth susceptibility from developmental tooth defects and negligence of oral hygiene as a result of greater concern with congenital heart disease. The major cause of gingivitis is due to the accumulation of microbial plaque in and around the dento-gingival complex. This may further give rise to a frequent bacteremia under normal physiological condition, leading to permanent risk of developing bacterial endocarditis.[12]

The mean decay component was slightly higher in the cardiac group compared to closely matched controls, though not statistically significant. The higher decay among the CHD children could be attributed to chronic intake of sweetened medication and frequent exposure to sweet and snack foods due to parental indulgence.[3,14,12,15]

However, as patients with more complex anomalies require several surgical interventions, it is particularly important that scheduled surgery should not have to be postponed because of dental disease. A significant fact is that the untreated and secondary caries can be a contraindication for heart surgery.[2] It was observed that the majority of the CHD

children required extraction, pulp therapy or restorations in this present study which reflected the reluctance of general practitioners to restore decayed teeth in medically compromised children. Another reason could be due to lack of regular dental care for these children, when they usually are admitted in hospitals for long periods because of surgery or illness.[16]

Therefore, the importance of maintaining a healthy, caries free oral cavity in these children should be emphasized. In addition, pulpally involved teeth would rather be extracted than restored thereby decreasing the risk for infective endocarditis from residual infection in primary tooth roots which may be difficult to debride thoroughly.[2,14,17]

The acidic salivary pH and decreased flow rate could result in the plaque accumulation on tooth surfaces, reduced clearance of debris and food by saliva resulting in gingivitis[18] as observed in the present study. It could be due to the lack of awareness among the parents and neglect of oral hygiene, which could have led to poor 'diet choices', that is, increased frequency of intake of sweet intakes, juice and soft drinks. Emesis and intake of medication such as diuretics for CHD was also commonly present.

Sialic acid, an abundant terminal monosaccharide of glycoconjugates, is a possible risk factor for CVD. Serum total sialic acid is a marker of a sustained inflammatory response in CVD[19] and positively correlated with the severity of the coronary lesions and reflects the existence or activity of an atherosclerotic process. Platelet and RBC sialic acid contents could be important determinants as the sialic acid has a direct effect on cell surface charge, survival of cells in blood circulation and their aggregability, which play important role in the pathogenesis of atherosclerosis.[5]

Sialic acids, present in salivary glands participate in the formation of the dental plaque. It has been reported that salivary sialic acid levels increased with salivary oxidative stress.[6] In diseased state such as CHD due to circulatory insufficiency, sialic acid is released into saliva in greater amounts[7] and was observed even in the present study. Sialic acid enhanced bacterial aggregation and would further participate in the formation of the acquired pellicle and dental plaque, thus resulting in gingivitis and increase in caries activity.

Hence, an aggressive preventive regimen should be commenced to maintain oral health and salivary levels optimum to the physiological needs of a healthy individual. An early preventive and a definitive corrective treatment protocol included in their anticipatory guidance should be maintained for every child with CHD, which will enable them to lead healthy childhood days.

CONCLUSION

The dental health status including the OHI, MGI, DC status, salivary pH and salivary flow rate were compromised and the treatment needs such as restoration, extraction, pulp therapy and oral prophylaxis were increased in CHD children. The salivary sialic acid levels were higher in CHD children with their compromised dental health compared to their healthy siblings.

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