Comparison of risk indicators of dental caries in children with and without cleft lip and palate deformities

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Abstract

Objective: To test the hypothesis that there are no differences in various risk factors of dental caries among children with cleft lip and palate when compared to non-cleft high caries risk and non-cleft caries free children. **Design:** Seventy-three children in the age range of 4–9 years comprised three groups; Group-I ($n = 23$, children with cleft lip and palate), Group-II ($n = 25$, non-cleft high caries risk children) and Group-III ($n = 25$, non-cleft caries free children). Various risk factors for dental caries like type of oral hygiene practice, sugar exposures/day, developmental defects of enamel, caries activity, salivary streptococci mutans levels and lactobacilli levels were evaluated and compared among the three groups of children. **Results:** The mean deft score among Group-II children was significantly more ($P < 0.01$) as compared to the Group-I children. The mean deft + DMFT score among Group-I and Group-II children was comparable ($P = 0.149$). Developmental enamel defects were more among Group-I children as compared to Group-II and Group-III children ($P < 0.01$). Hypoplasia of the maxillary anterior teeth was more common among Group-I children as compared to Group-II ($P < 0.05$) and Group-III children ($P < 0.001$). The association between hypoplastic teeth and dental caries was significant ($P < 0.05$). The salivary acidogenic potential as evaluated by Snyder test was comparable among Group-I and Group-II children. The salivary streptococcus mutans levels in Group-I and Group-II children were higher when compared to lactobacillus counts. **Conclusion:** The risk factors of dental caries among children with cleft lip and palate were more as compared to non-cleft high caries risk and non-cleft caries free children.

Keywords: Cleft lip and palate, dental caries, risk factors

Introduction

Children with cleft lip and palate require a multidisciplinary approach in their management. In majority of the standard protocols designed for the management of children with cleft lip and/or palate, globally, the role of pediatric dentist has not been referred to, in spite of the high prevalence of dental caries, gum diseases and developmental defects reported in these children. These children are at high risk of developing dental caries,[1-4] with a reported deft score ranging between 2.35 and 13.5 among different communities around the world.[1,5] The high prevalence of dental diseases in children with cleft lip and/or palate has been attributed to irregularity of teeth, anatomy of cleft area, tight repaired lip with a tendency for food to accumulate in the cleft area, nasal discharge through cleft which acts as a feast for cariogenic microorganisms, hypoplastic defects, prolonged feeding especially at night time and increased consumption of sugary foods.[1-6]

In spite of reported high caries prevalence, a few studies[1-3,7,8] have been conducted to evaluate the cariogenic risk factors in these children for planning and implementing an effective primary preventive oral health regimen, at an early age and also to give pediatric oral health care its due position in management of these children. The present study evaluated various risk factors of dental caries viz. sugar exposures/day, hypoplastic defects in teeth, salivary acidogenic potential, brushing frequency and salivary levels of cariogenic bacteria in children with cleft lip and palate and compared these parameters with age-matched non-cleft high caries risk children and non-cleft caries free children.

Materials and Methods

Seventy-three children in the age range of 4–9 years were distributed into three groups. Group-I included 23 children with cleft lip and palate who were selected from among

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87 children, with no history of previous dental visits. Group-II included 25 healthy, non-cleft high caries risk children and Group-III also included 25 healthy, non-cleft caries free children. All the children included in Group-II and Group-III were randomly selected from a total of 470 school children of Chandigarh aged 4–9 years after a thorough screening for caries in natural light using a mouth mirror and a probe. The criterion for high caries risk selection was deft + DMFT score >5 (cavitated), as per Modified Koch's caries recording criteria (1967).[9] All children included in the three study groups were matched for age, sex and social class. Children with any diagnosed systemic and metabolic disorders like rickets, hyperparathyroidism, osteomalacia, osteitis deformans or with mental retardation or known syndrome cases were excluded. Also, children undergoing orthodontic treatment and those with a history of antibiotic intake during the last 1 month were excluded from the study. A written informed consent was obtained from parents of all the children included in the study and also approval from Institute Review Board was obtained.

The parents of every child were interviewed using a structured questionnaire about the demographic data, frequency of tooth brushing, type of toothpaste used and its frequency and 24 h dietary recall. The developmental defects of enamel were recorded using Developmental Defects of Enamel Index.[10]

The acidogenic potential of saliva denoting the caries activity was assessed by using an improved Snyder's test,[11] using commercially available B-C-G dextrose agar (Snyder Test Agar: HiMedia Laboratories PVT Ltd, Mumbai). The caries activity was assessed as per color changes obtained in the Snyder tubes, evaluated every 24 h till 96 h of incubation at 37°C. The levels of streptococci mutans in saliva of the children of three study groups were analyzed using Dentocult SM "Strip Mutans Test Kits" (Orion Diagnostica, Helsinki, Finland) following the method of Jensen and Bratthall (1989).[12] Lactobacilli levels were assessed by conventional method (Rogosa and Mitchell, 1951)[13] using Mann Rogosa Sharpe agar. Stimulated saliva for both these tests was collected from children by chewing on paraffin wax, between 11 am and 1 pm, on the day of saliva collection, at least 1 h after eating, tooth brushing or using any mouth wash. In order to evaluate the caries activity, children were asked to drool the saliva on the surface of Snyder media in 5 ml borosil tubes, which were then incubated at 37°C. The estimation of streptococci mutans levels was done after incubation of strips in Dentocult tubes at 37°C for 2 days, and the results were compared to the standard interpretation chart provided by manufacturer. The lactobacilli counts were estimated in saliva (Rogosa and Mitchell, 1951)[13] at the Department of Microbiology of the Institute, within an hour of collection, identified by colony morphology and Gram staining.

Statistical analysis

The data were analyzed using Statistical Package for the Social Sciences Software (SPSS Inc., Chicago, IL, version 15.0 for Windows, version-14). The data were subjected to descriptive statistics. Mann Whitney test was used for comparing the dental caries status in the different groups. Chi-square test was used for analyzing the microbiological parameters, caries activity test and distribution of dental abnormalities. $P = 0.05$ was considered as level of statistical significance.

Results

The mean age of children in the Group-I, Group-II and Group-III were 6.55 ± 1.8 years, 6.09 ± 1.3 years and 7.01 ± 1.2 years respectively. The status of dental caries among Group-I and Group-II children is described in Table 1. The mean deft + DMFT (mixed dentition) score in Group-II children was more but comparable to Group-I children. The deft score among Group-I children was significantly less (8.65 ± 5.80 Vs 12.64 ± 3.43) as compared to Group-II children ($P < 0.01$).

The distribution of developmental defects and enamel hypoplasia among three groups of children is depicted in Table 2. The developmental defects of the enamel were significantly more in the Group-I children when compared to the Group-II and Group-III children ($P < 0.01$). The enamel hypoplastic lesions in Group-I children were significantly more as compared to the Group-II ($P < 0.05$) and Group-III children ($P < 0.01$). The association between hypoplastic

Table 1: Caries status of Group-I and Group-II children

Groups	*n*	Deft	Deft+DMFT	
		Mean±SD	Mean±SD	Range
I	23	8.65±5.80	10.14±6.09	0-20
II	25	12.64±3.43	12.73±3.42	8-19
P value (significance)	0.006**		0.149	

SD: Standard deviation; DMFT: Decayed, missing, filled teeth. **P<0.01

Table 2: The distribution of developmental defects and enamel hypoplasia among three groups of children

Children with developmental defects and enamel hypoplasia	*n* (%)			Comparison (*P* value)		
	Group-I (*n*=23)	Group-II (*n*=25)	Group-III (*n*=25)	I-II	I-III	II-III
Children with developmental defects on enamel	15 (65.2)	3 (12)	2 (8)	0.008**	0.004**	0.63
Children with hypoplastic enamel	10 (43.5)	3 (12)	2 (8)	0.010*	0.005**	0.63

*P<0.05, **P<0.01

teeth and dental caries was found to be statistically significant ($P = 0.04$) [Table 3].

Frequency of sugar exposures more than three times/day was found to be the highest in Group-I children (100%) when compared to Group-II (96%) and Group-III (72%) children [Figure 1]. Intergroup comparison showed statistically significant differences among Group-I and Group-III ($P < 0.006$). When oral hygiene practices were evaluated, no significant differences were observed among the three groups in relation to frequency of tooth brushing, percentage using fluoridated toothpaste and its frequency/day.

The acidogenic potential of saliva as evaluated by Snyder test showed statistically significant difference between Group-III and Group-II ($P < 0.000$) and Group-III and Group-I ($P < 0.000$) [Figure 2].

The levels of mutans streptococci $>10^6$ CFU/mL (Score 3) were found in 60% of Group-II children and 21.7% of Group-I children and only in one child in caries free group (Group III). Mutans streptococci levels between 10^5 and 10^6 CFU/mL (Score 2) were found in 35% of children in Group-I, 28% in Group-II and only 12% ($n = 3$) in Group-III. None of the children in the high caries risk group had score of 0 ($<10^4$ CFU/mL) while 17% and 32% children in Group-I and Group-III respectively had these low levels. There was statistically significant difference between Group-I and Group-III children ($P < 0.05$) and between Group-I and Group-II children ($P < 0.001$) [Figure 3].

The lactobacilli levels in saliva of the children in the three study groups are described in Table 4. The lactobacilli levels were detected only in 24% of Group-II children, 22% of Group-I children and only 8% of Group-III children. The difference in lactobacilli levels between groups was however not statistically significant.

Table 3: The association between hypoplastic teeth and dental caries among three groups of children

Association between hypoplastic teeth and dental caries	*n* (%)			χ^2	*P*
	Group-I	Group-II	Group-III		
Hypoplastic teeth with caries	4 (25)	0 (0)	0 (0)	6.163	0.04*
Total number of hypoplastic teeth	16 (100)	3 (100)	2 (100)		

*$P<0.05$

Table 4: The *lactobacilli* levels in saliva of children in the three study groups

Groups	*n*	Children with detectable *Lactobacilli* counts *n* (%)	*Lactobacilli* (10^4 CFU/mL)	*P*
I	23	5 (21.7)	1.9±1.25	0.13
II	25	6 (24)	2.03±0.49	
III	25	2 (8)	0.45±0.49	
Total	73	13 (17.8)	1.7±1.09	

CFU: Colony-forming units

Discussion

Caries experience in children with cleft lip and palate (Group-I) was comparable to those in high caries risk group (Group-II)

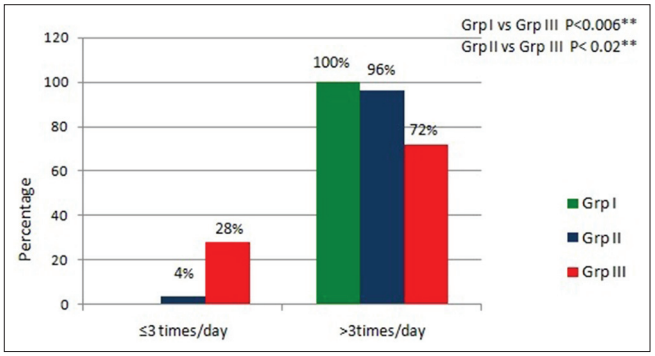

Figure 1: Frequency of sugar exposure among three groups of children

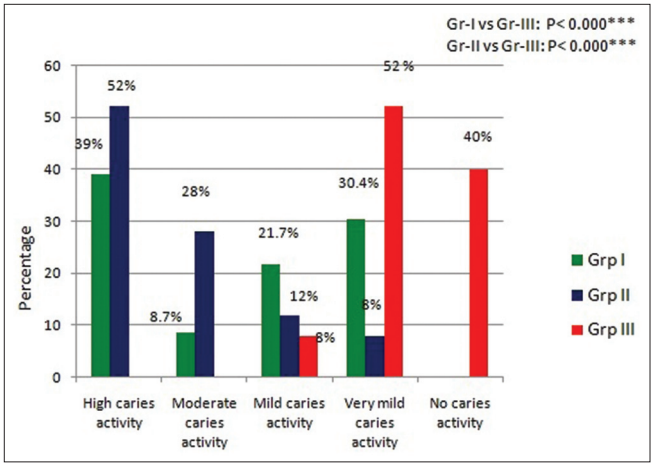

Figure 2: The acidogenic potential of saliva as evaluated by Snyder test among three groups of children

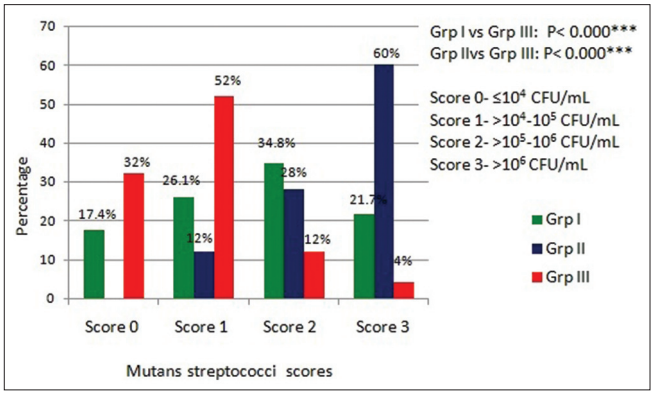

Figure 3: Streptococci mutans levels in saliva among three groups of children

in this study, labeling them (Group-I) as at high risk for dental caries. Similar to our observation many previous studies also reported high prevalence of dental caries in children with cleft lip and/or palate.[3,5,14] In the present study, the risk factors for dental caries were evaluated in detail in these children and compared with age-matched non-cleft high caries risk and non-cleft caries-free children. A high percentage of children with cleft lip and palate (65%) had developmental defects in maxillary anterior region. Amaratunga (1987)[15] and Dixon (1968)[16] have reported a prevalence of 37.2% and 35.7% respectively of these defects in children with cleft lip and/or palate, though the prevalence was less as compared to the present study. The defects in teeth in close proximity to the cleft region occur because of the factors involved in biological clefting process, which interfere with normal blood supply and hence cellular metabolism in the region.[15,17] The teeth adjacent to cleft are also susceptible to trauma during the period of lip surgery, which is normally done at 3 months of age,[18] leading to defects in enamel of maxillary anteriors, which are in active stages of calcification between 3 and 12 months of life.

The acidogenic potential of saliva was evaluated using Snyder test that directly measures the rapidity of acid formation in the oral cavity and indirectly the quantitative assessment of acidogenic and aciduric bacteria. In Group-I, 39% of children showed high caries activity and 8.7% moderate caries cavity. These children with cleft lip and palate (CLP) deformities can thus be labeled as children at high caries risk, who need to be diagnosed and managed similar to high caries risk children. Ali *et al*., (1998),[19] in a comparative study on caries free children, those with average caries and rampant caries, showed that caries free individuals had low mutans streptococci count and their diet was mildly or moderately conducive to dental caries compared to average caries individuals who had medium levels of mutans streptococci counts and their diet was conducive to a moderately high degree of dental caries, the rampant caries or high caries risk individuals had high colony-forming units (CFU) of mutans streptococci and their diet was also highly conducive. The time and extent of color change of Snyder medium determines the conduciveness of the diet. Hence in the present study, approximately 50% of the children with cleft lip and palate, who showed high or moderate caries activity, are at high risk of dental caries.

Mutans streptococci have been implicated in the initiation of dental caries by many investigators.[20,21] A limited data are available on the microbiological parameters of children with cleft lip and palate. Bokhout *et al*. (1997)[22] conducted a study on 18 month old Dutch children with cleft lip and palate and revealed that mutans streptococci could be isolated from saliva of 45% children and plaque of 48% children, while Lucas *et al*. (2000)[5] found no significant difference in the isolation frequency of streptococcus mutans in 25, 3–15 year old children with cleft lip and palate and their age matched controls. In the present study, there was no significant difference in the isolation frequency of mutans streptococci in the cleft group and high caries risk group. Only four children in the cleft group had score 0, while none of the children had this score in high caries risk group. Majority of children with high caries (Groups I and II) had mutans streptococci levels $>10^5$ CFU/mL of saliva.

Lactobacilli have been associated with progression of dental caries[23,24] and were acidogenic and highly aciduric bacteria that are able to survive in low potential of Hydrogen (pH) in deep dentinal lesions. The lactobacilli could be detected in only 1/4th of children of CLP group and 1/4th of high caries risk group in the present study, as these are found in deep dentinal lesions and salivary levels are actually not the true reflection of lactobacilli count, as reflected in this study. Lactobacilli could not be detected in 76% and 78% of children in Group-I and Group-II respectively of the present study, possibly because, they represent 0.1% of the total salivary flora and a critical concentration of 10^5 CFU of bacterial flora per milliliter of saliva is necessary for the detection of lactobacilli on the surface of enamel.[25]

Among the microbiological parameters, mutans streptococci have shown strong and significant association with dental caries in the present study compared to lactobacilli counts. In a study on 18 months old Dutch children with cleft lip and palate, mutans streptococci in saliva could be detected in 45% of the children, while lactobacilli were found in only 8% of the same children.[3] Lucas *et al*. (2000)[5] also showed a low prevalence of lactobacilli and no significant difference in the isolation frequency of lactobacilli from a proximal site distal to maxillary cleft in children aged 3–15 years with cleft lip and palate (16%) and control group (12%). It could also be concluded from the results of the present study as well as from earlier studies[3,5,26] that salivary lactobacilli counts are not a good indicator of caries status.

On evaluating various risk factors for dental caries in children with cleft lip and palate, it was found that these children are comparable to non-cleft high caries risk children and are at a high risk for developing dental caries. Caries activity as per Snyder test and mutans streptococci levels in saliva are good screening methods to identify these high risk children with cleft lip and/or palate, though use of multiple risk factors in combination is necessary to evaluate the true risk for dental caries. There is an imperative need to implement primary preventive strategies on oral health at an early age in these children, similar to the ones for high-risk caries children viz. thorough brushing thrice per day, use of fluoridated toothpaste, restriction of eating anything sweet to not more than 3 times/day, etc. The services of pediatric dentists should be integrated into the standard protocols designed and available for management of children with cleft lip and/or palate at all cleft centers, the world over.

Conclusions

The following conclusions were drawn from the present study:

- The dental caries status among children with cleft lip and palate and children with high-risk caries was comparable
- The developmental defects and hypoplastic lesions on the enamel surface were more among children with cleft lip and palate as compared to the normal non-cleft children
- The frequency of sugar exposure among children with cleft lip and palate was more
- The acidogenic potential of saliva and salivary streptococcus mutans levels were comparable among children with cleft lip and palate and high caries risk children.

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