Caries Experience in Filipino Children with Cleft Lip and/or Palate from the Noordhoff Craniofacial Foundation, Philippines

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ABSTRACT

Objective. This study aims to provide an overview and statistical data on the prevalence of dental caries and caries index scores in Filipino children from the Noordhoff Craniofacial Foundation Philippines, Incorporated (NCFPI).

Methods. A retrospective quantitative descriptive study was undertaken based on pretreatment records of 332 children aged 2 to12 years, with cleft lip (CL), cleft palate (CP), or cleft lip and palate (CLP).

Results. The prevalence of caries ranged from 81% to 100%. There were significant differences in dmft scores between the 2 to 5 year-olds and the 6 to 9 year-olds ($p<0.0001$), and between the 6 to 9 year-olds and the 10 to 12 year-olds ($p<0.0001$). There were also significant differences between the DMFT scores of the 6 to 9 year-olds and the 10 to 12 year-olds ($p<0.0001$), between the CL and CP groups ($p<0.0001$), and between the CL and CLP groups($p<0.0001$). There were no significant differences in dmft and DMFT scores between the males and females.

Conclusion. There is high caries prevalence in children with CL, CP and CLP. Caries index scores are higher with increasing age. Poor oral hygiene and the presence of other predisposing factors increase their susceptibility to caries.

Key Words: cleft lip and palate, caries, incidence, Philippines

Introduction

Cleft lip and palate (CLP) is one of the most common congenital craniofacial abnormalities of newborns in the Philippines.[1] The Philippines has one of the highest rates of oral clefting in the world, affecting approximately 1 out of 500 newborns[2] in the country. In a series of epidemiologic studies done from 1989 to 1996 in six sites within the country, the prevalence of cleft lip and palate was 1.94 per 1000 live births.[3] An infant/child with oral cleft endures physical disabilities like speech, hearing, and dental problems.[4] Due to this defect, the child's oral health and function are compromised. Children with CLP have a higher prevalence of dental abnormalities than do children without clefts. Tooth malformations and malpositions, along with problems such as crowding and the presence of fistulas, are among the predisposing factors in the development of dental caries. Due to the presence of these predisposing factors in children with CLP, one can assume for them to have a high caries index.[5]

The prevalence of dental caries in patients with CLP has been researched extensively in different parts of the world.[6–11] However, there is little published research regarding dental caries prevalence and/or incidence in individuals with CLP in the Philippines. On the other hand, the 2006 National Oral Health Survey conducted among the public school population in the Philippines has shown that 6-year-old schoolchildren have 97% overall caries prevalence.[12] The same report disclosed that 12 year-old Filipino children have 82% overall caries prevalence in both the primary and permanent dentition. These findings show just how much dental caries continues to be a problem even for noncleft Filipino children.

The Noordhooff Craniofacial Foundation Philippines, Inc. (NCFPI) was chosen as the source of the sample population because it provides the most comprehensive, multidisciplinary care (e.g. General Dentistry, Orthodontics, Speech Therapy, Pediatrics, Pediatric Dentistry, Oral and Maxillofacial Surgery, Plastic Surgery, etc.) out of all organizations in the Philippines providing cleft treatment from birth to adulthood.

The study aims to provide an overview and statistical data on the incidence and prevalence of dental caries in Filipino children with CLP. With these, comparative studies on caries incidence between children with CLP and control groups may be done in future studies. These data can also be used by dental health care professionals as a guide in imparting the necessary oral hygiene instructions to the

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parents and caregivers of children with CLP, in order to lessen pre-surgical dental treatment in other cases of CLP in the future. Since a multidisciplinary and holistic approach is being advocated for the treatment of CLP, effective caries prevention measures will be beneficial to organizations and foundations that provide a wide range of treatment procedures.

Methods

A retrospective quantitative descriptive study was carried out based on pretreatment records of children with CLP from NCFPI. These children were treated by dentists from the Pediatric Dentistry Center Philippines (PDCP) from 2009 to 2012 at NCFPI's craniofacial center. Statistical data on the incidence of dental caries in relation to age, sex, and type of oral cleft were collected and analyzed. NCFPI and PDCP solicited informed consent during the initial consultation. This study was approved by the ethical review board of the University of the Philippines College of Dentistry.

The criteria for the population included male and female Filipino children, aged 2 to 12 years with unilateral or bilateral cleft lip (CL), cleft palate (CP), or cleft lip and palate (CLP) who were treated at Our Lady of Peace Hospital Craniofacial Center (OLPCC), a center operated by the NCFPI. Those with associated congenital malformations or syndromes and contributory systemic diseases were excluded from the study. The data gathered included the patients' age, gender, cleft type, and dmft/ DMFT records. The dmft measures the number of decayed, missing and filled teeth in the primary dentition, while the DMFT is the counterpart measure for the permanent teeth. Both are universally accepted standard measures of caries experience. Higher dmft/DMFT scores indicate more numbers of teeth that are decayed, missing and filled.

Relevant data from the questionnaires incorporated in the patient records were also reviewed to draw information related to the children's oral health status and caries risk-assessment. A total of 395 dental records of NCFPI patients passed the criteria and out of this number, a total of 332 contained the complete data. Most of the subjects came from the National Capital Region (NCR) and Region IV-A (CALABARZON). However, there were a few who came from Visayas and Mindanao (0.02%).

Using purposive sampling, the population was grouped according to age, sex, and cleft type (CL, CP, or CLP). Since NCFPI has treated approximately a total of 2,500 patients as of this writing, records dating from 2009 up to 2012 were utilized to acquire an ample amount of samples. The computed sample size with a confidence level of 95%, was determined to be 334.

For the caries incidence based on age, the children were grouped based on age range- 2-5 years old (primary dentition), 6-9 years old (early mixed dentition) and 10-12 years old (late mixed dentition). Table 1 shows the distribution of the sample according to sex and age group. Table 2 shows the number of children with primary and permanent teeth by age group while Table 3 shows the number of children with primary and permanent teeth by cleft type.

Table 1. Sample distribution by sex and age group

Age Group (years)	Male		Female	
	Frequency	%	Frequency	%
2 - 5	113	34.03	96	28.92
6 - 9	56	16.87	41	12.35
10 - 12	13	3.92	13	3.91
Total	182	54.82	150	45.18

Table 2. Number of children with primary and permanent teeth, by age group

Age group	Number of children with primary teeth	Number of children with permanent teeth
2 to 5	209	14
6 to 9	93	84
10 to 12	16	25

Table 3. Number of children with primary teeth and permanent teeth, by cleft type

Cleft type	Number of children with primary teeth	Number of children with permanent teeth
Cleft lip	58	20
Cleft palate	58	22
Cleft lip and palate	133	50

The data were analyzed by using Microsoft Excel 2013 and MedCalc 16.1. The Mann Whitney-U test was used to determine significant differences between the different age groups, the sexes and the different cleft types. The level of significance was set at $p<0.05$.

Results

Table 4 shows the average dmft, DMFT, their components and standard deviation by age group. The mean dmft values were 11.8, 11.98 and 3.4 for the 2 to 5-year-olds, the 6 to 9-year-olds and the 10 to 12-year-olds, respectively. The mean DMFT scores were 3.39 and 8.80 for the 6 to 9 year-olds and the 10 to 12-year-olds, respectively.

Table 5 shows the mean and standard deviation of the caries indices by sex. The mean dmft scores for males and females were almost the same -- 11.49 and 11.31, respectively. The mean DMFT values for males and females were 4.10 and 4.19, respectively.

Table 6 shows the mean caries indices and standard deviation by cleft type. The mean dmft scores for the cleft lip, cleft palate, and the cleft lip and palate groups were: 10.96, 12.43 and 11.45, respectively. The mean DMFT scores were 3.35, 3.41 and 4.4, respectively.

Table 4. Mean and standard deviation of caries indices in children with oral clefts by age group

Variable	2 to 5 year-olds	6 to 9 year-olds	10 to 12 year-olds
Prevalence dmft / DMFT	95.12%	100% / 83.53%	81%/ 100%
dt±SD / DT±SD	10.96±6.02	10.38±4.49 / 3.03±2.30	3.75±2.72 / 7.28±4.95
mt±SD / MT±SD	0.67±1.43	1.44±2.66 / 0.14±0.54	0.375±0.62 / 0.92±1.35
ft±SD / FT±SD	0.06±0.39	0.16±0.74 /0.12±0.66	0.12±0.34 / 0.60±1.85
dmft±SD / DMFT±SD	11.80±6.05	11.98±4.46 / 3.39±1.91	3.40±2.72 / 8.80±4.12

Table 5. Mean and standard deviation of caries indices in children with oral clefts by sex

Variable	Females	Males
Prevalence dmft / DMFT	97.16% / 79.66%	96.53% / 81.82%
dt±SD/ DT±SD	10.26±5.84/ 3.60±3.64	10.56±5.5 / 3.59±3.49
mt±SD / MT±SD	0.97±2.13 / 0.33±0.78	0.81±1.68 / 0.24±0.84
ft±SD / FT±SD	0.08±0.46 / 0.26±1.25	0.10±0.56 / 0.15±0.73
dmft±SD / DMFT±SD	11.31±5.81 / 4.19±4.04	11.49±5.50 / 4.10±3.85

Table 6. Mean and standard deviation of caries indices in children with oral clefts by cleft type

Variable	Cleft lip	Cleft palate	Cleft lip and palate
Prevalence dmft / DMFT	95.83% / 80.95%	98.28% / 72.73%	96.99% / 80.00%
dt±SD / DT±SD	9.84±6.03 / 3.15±3.45	11.60±5.70 / 3.18±3.26	10.55±5.19 / 3.78±3.17
mt±SD / MT±SD	1.02±2.16 / 0.20±0.52	0.72±1.87 / 0.23±0.96	0.81±1.12 / 0.34±0.61
ft±SD / FT±SD	0.10±0.48 / 0	0.10±0.44 / 0	0.08±0.58 / 0
dmft±SD / DMFT±SD	10.96±6.15 / 3.35±3.80	12.43±5.64 / 3.41±5.58	11.45±5.07 / 4.4±5.07

Table 7. P values of mean caries indices between different age groups, sexes and cleft types

Variables	dmft	DMFT
Age group		
2 to 5 year-olds vs. 6 to 9-year olds	0.85	---
2 to 5 year-olds vs. 10 to 12 year-olds	< 0.0001	---
6 to 9 year-olds vs. 10 to 12 year-olds	< 0.0001	< 0.0001
Sex		
Males vs. Females	0.84	0.94
Cleft type		
Cleft lip vs. cleft palate	0.30	< 0.0001
Cleft lip vs. cleft lip and palate	0.84	< 0.0001
Cleft palate vs. cleft lip and palate	0.29	0.33

Table 8. Oral hygiene behavior and risk-assessment

Oral hygiene behavior	*Yes*	*No*
First dental visit	142	27
Experiences difficulty in tooth brushing	64	34
Has received fluoride in any form	62	50
Habits	**Incidence**	
Night time bottle feeding	79	
Thumb sucking	14	
Tongue thrusting	6	
Teeth grinding	10	
Nail biting	7	
Mouth breathing	7	

Table 7 shows the p values comparing the mean dmft and DMFT scores among the different age groups, sexes and cleft types. There were significant differences in dmft scores between the 2 to 5-year-olds and the 6 to 9-year-olds ($p<0.0001$), and between the 6 to 9-year-olds and the 10 to 12-year-olds ($p<0.0001$). There were also significant differences between the DMFT scores of the 6 to 9 year-olds and the 10 to 12-year-olds ($p<0.0001$), between the CL and CP groups ($p<0.0001$), and between the CL and CLP groups($p<0.0001$).

The questionnaire incorporated in the patient records included questions regarding the patient's oral hygiene and assessment of caries risk. A total of 169 dental records with answered questionnaires (51%) were reviewed. Table 8 shows the tally of the recorded answers. Most guardians noted that their child brushes his/her teeth just once daily or sometimes do not brush at all. Only 9.47% of the questionnaire respondents claimed that their children brush their teeth 2-3 times a day. Sixty-two (36.9%) responded yes when asked if their child has received fluoride; most of them mentioned fluoride in the form of toothpaste.

A checklist of oral habits was included in the oral health risk assessment sheet. Among them, night time bottle feeding was the most common with 46.74%, followed by thumb sucking and teeth grinding with 8.28% and 5.92%, respectively. The frequency of snacking also showed that the subjects snacked frequently (about 3 times daily), and that their diet included bread, milk, soft drinks, chips, juice, and chocolates, among others. Dental charts also revealed that most of the subjects were diagnosed with mild gingivitis upon the first visit.

Discussion

There is little information about the incidence and prevalence of caries in individuals with CLP in the Philippines. A study by Jindal et al[13] reported that the DMFT in individuals aged 0 to >45 years old with clefts in the Philippines (n=103), was 11.7. The higher DMFT in Jindal's study compared to the present study may be due to the wider range of ages of the subjects and the location from which the subjects were recruited (Cebu) in the former study.

The results of the present study are similar to the findings of Al-Wahadni et al,[9] Chapple and Nunn,[10] and Xiao

Table 9. Studies of caries prevalence in individuals with cleft lip and palate compared to noncleft individuals

Year published	Author	Country	Age (years)	Sample population	dmft	DMFT	Increased caries experience compared to noncleft controls?
2013	Antonarakis, Palaska & Herzog	Meta-analysis of 7 studies	1.5-29	474	1.51*	1.38*	Yes
2013	King et al.	China	2-7	132	1.5 (2-4 age group) 5.2 (5-7 age group)	NA	Yes (in the 5-7 age group)
2012	Freitas et al.	Brazil	12-21	30	NA	8.2	Yes
2012	Tannure et al.	Brazil	4-21	115	1.68	1.2	No
2011	Jindal et al.	Philippines, Guatemala and Argentina	<6->45	1,593	2.47 (<6 age group) 5.03 (6 to 12 age group)	8.13	No
2010	Britton & Wellbury	Scotland	0.5-6	209	1.138**	NA	Yes (in the 4.5-6 age group)
2010	Zhu et al.	China	3-25	380	2.53-2.44	2.56-4.04	Yes
2009	Al-Dajani	Syria	12-29	106	NA	6.83	Yes
2008	Mutarai, Ritthagol and Hunsrisakhun	Thailand	1.5 - 3	138	9.1	NA	Yes
2007	Stec-Slonicz, Szczepańska & Hirschfelder	Poland and Germany	3.5-18	100	2.06	5.25	Yes (compared to general population)
2005	Al-Wahadni, Alhaija & Al-Omari	Jordan	10-38	32	NA	4.76 (10-15 age group) 5.42 (16-38 age group)	Yes (in the 14-16 age group compared to general population)
2004	Besseling & Dubois	Vietnam	4-16	154	11.20	5.06 (11-13 age group) 7.07 (14-16 age group)	Yes
2004	Lages et al.	Brazil	1-32	78	2.77-2.91	1.87-13.62	No (compared to general population)
1989	Dahllöf	Sweden	5.5 (mean)	49	7.0	NA	Yes
1964	Lauterstein & Mendelsohn	USA	9 (mean)	285	NA	8.01	No

* mean difference compared to matched noncleft controls

** mean dmft for all age groups

et al.[14] The prevalence of caries increased with increasing age. This may be related to the toothbrushing technique and dietary habits. The patients' records showed that tooth brushing of the younger children (<6 years old) is usually performed by their parents or guardians, while those aged 6 to 12 years mostly brush their teeth by themselves. Thoroughness and frequency of brushing may be significantly reduced when the child is not motivated or monitored by their parents. Proper brushing technique may not be practiced by the children. In addition, the level of manual dexterity, especially in young children, may be a significant factor in proper brushing of the teeth. Yiu and Wei[15] stated that children spend less than 60 seconds brushing their teeth and brush their teeth that are least susceptible to caries. Another factor which may contribute to high susceptibility to dental caries is the intake of sugary food and drink by the children. Older children already attend school and have greater autonomy in choosing what to eat because their diet may not be monitored by their parents.

The results of the present study agree with those of Bian et al,[16] and Chapple and Nunn,[10] where there were significant differences in caries experience between those with CL and CP and between those who had CL and CLP. These differences may be attributed to the fact that as a child grows older, there is inadequate access for optimal tooth cleaning in the maxillary anterior area because of the development of crowding and malpositions in those with CP and CLP. On the other hand, no significant difference in caries incidence among different cleft types were reported by Dahllof et al.,[5] Al-Wahadni et al[9] and Stec-Slonicz et al.[8] This may be attributed to dissimilarities in age groups, socioeconomic background and dietary habits compared to the present study.

The present findings concur with those of Bian et al,[16] where there were no significant differences in caries experience between males and females. As of this writing, gender is not a common contributing factor being studied in reports about caries experience in children with clefts.

When compared to other countries, the mean caries indices in the present study were higher compared to studies done in Brazil,[17–19] China,[6,20] Jordan,[9] Poland and Germany,[8] Sweden,[5] Syria,[21] Thailand,[22] USA,[23] and Vietnam[24] (Table 9). These differences may be attributed to socioeconomic status, diet or feeding habits in the different studies. On the other hand, caries incidence in these countries may be attributed to factors related to (1) lack of knowledge (fear of brushing the teeth near the cleft, prioritization of medical procedures at the expense of dental treatment and improper tooth brushing technique); (2) socioeconomic circumstances (high cost of professional care, transportation problems and lack of time for dental treatment), and; (3) the defect or anatomy (crowding in the anterior area near the cleft which increases the risk for proximal caries, higher incidence of enamel hypomineralization near the alveolar cleft, and difficulty in tooth cleaning because of crowding and the presence of scar tissue).[5,7,9,16]

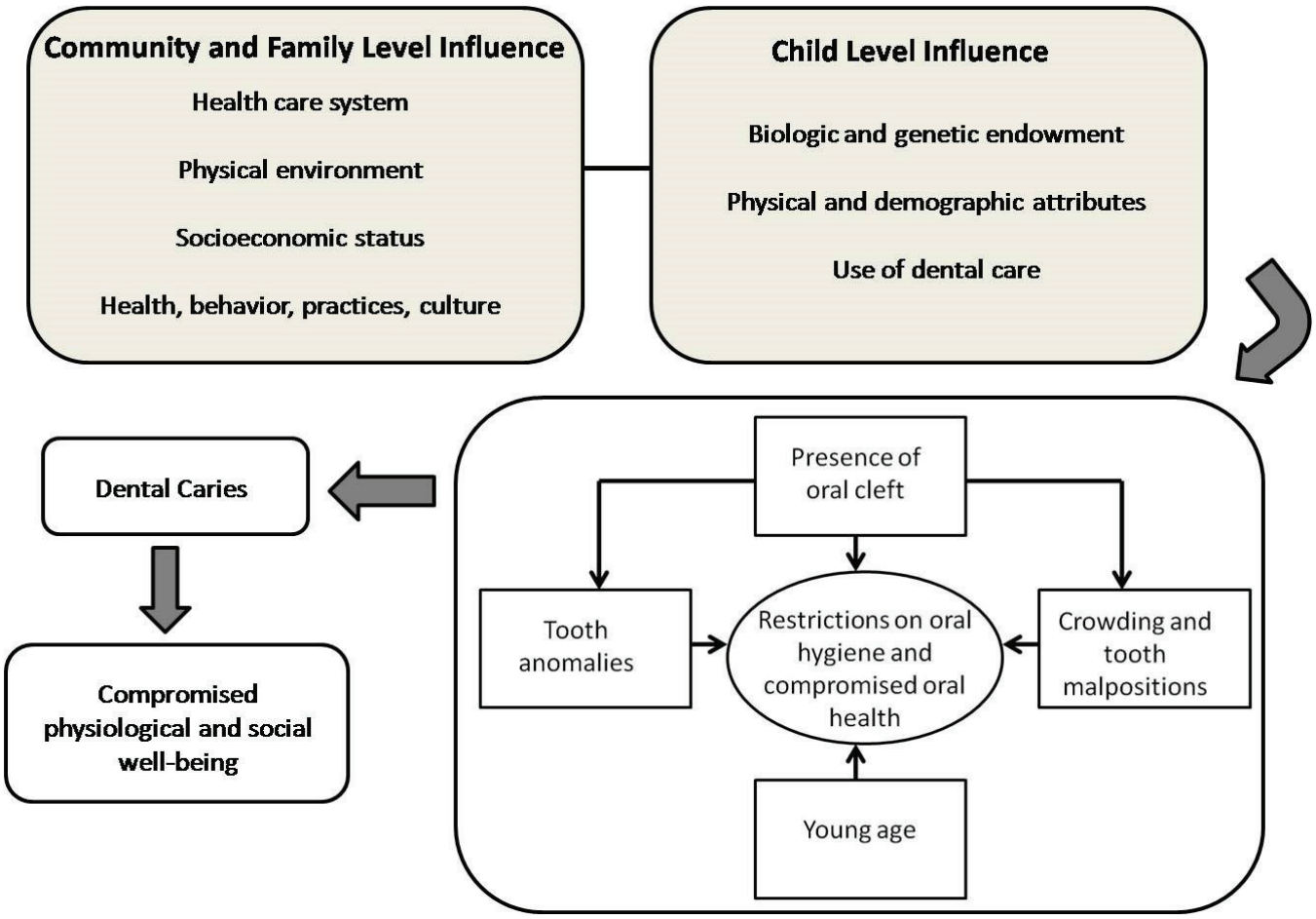

Figure 1. A multi-factorial view on the development of dental caries in children with CLP.

Since the treatment of most of the patients in this study were wholly subsidized by the foundation, it may be assumed that these patients most likely came from low socio-economic families. This means that their dental needs are lower in priority compared to basic needs and medical procedures required in order to treat the cleft. Patients and their parents may be preoccupied with other aspects of their health such as surgery and nutrition that often dental needs are neglected.[6] Family income and educational level have been shown, in other studies, to affect caries risk, receptivity to instructions from health care professionals, regularity of dental consultations and restriction on the consumption of sweets.[25–27] These may explain the high caries index scores of these patients in the present study.

Reports that investigated the prevalence of dental caries in cleft individuals, compared to noncleft controls or the general population have been done in other countries and a summary of their findings are shown in Table 9. An overwhelming majority of those studies[5,6,8,9,20–22,28,29] indicate that there is a higher incidence of caries in individuals with clefts compared to noncleft individuals. The results of the present study indicate that there is high caries experience in children with CL, CP and CLP. The figures in the present study are quite high compared to the World Health Organization and Federacion Dentaire Internationale's millennium goals of a 50% reduction in caries incidence in 5-6 year-olds and a DMFT of 3 by the age of 12.[30]

Patients with CLP generally display poorer oral hygiene and higher susceptibility to caries because of the difficulty in achieving adequate plaque control associated with dental anomalies and defects from the lip or palate.[31] Some of the causes that have been suggested are the irregularity of the teeth4 and longer oral clearance time.[32] Besseling[24] proposed other reasons such as dry mouth caused by mouth breathing habits, less natural cleaning of the teeth because of the morphology and differences in the diet and feeding habits. Parapanisou et al.[7] suggested that difficulty in tooth cleaning because of the residual scar tissues, lack of interest in oral hygiene due to many other health problems and the fear of brushing in the cleft area.

In a few articles where there was no significant difference in caries experience between patients with CLP and noncleft controls,[18] the sample population came from a country where universal health care include oral health

measures for all.[33] No significant differences were also found in Lauterstein and Mendelsohn's article,[23] because the control group consisted of the same patients with CLP, but used the teeth on the noncleft side and the lower arch.

The present findings indicate that night time bottle feeding was found to be the leading habit of children with CLP, which is in concurrence with the results of the study done by Mutarai et al.[22] This habit exposes the teeth to acids produced by cariogenic bacteria, which in turn increases the susceptibility to caries. Another contributing factor is mouth breathing, which causes the mouth to dry and prevents the protective cleansing action of saliva against oral bacteria and the acids that they produce.

Based on NSO's 2000 Census on Disability results and the National Council Disability Affairs, the total number of children in the Philippines aged 1 to 14 with oral defects is 18,128. However, since there are no specific national data regarding non-syndromic oral clefts in the Philippines for the 2 to 12-year-old age group and because the present study is descriptive by nature, it would be difficult to extrapolate the percentage of subjects included in the present study to the national population. If we extrapolate data using the ratio of 1.94 per 100 live births,[3] to the number of live births when the subjects were born, the data shown here represents approximately 0.7% of the total children with oral clefts between 2 and 12 years old.

Based on the present research, the relationship of the different factors which affect caries experience in a child with an oral cleft is presented in Figure 1, based on Fisher-Owens et al.'s[34] study. A child's oral health is influenced by factors from the community, family and child level. Dental caries, which may lead to loss of teeth, consequently affects the physiological and social well-being of the child.

There are many ways to decrease the incidence and prevalence of caries. It has been suggested that the first dental visit be done as soon as the child reaches the age of one, or even earlier, than when dental problems are already identified in order to provide preventive measures against caries formation.[35] Parent-supervised brushing prior to the age of 7 has been advocated as a national guidance in the United Kingdom.[36] In the Philippines, fluoride, in the form of fluoridated toothpaste is the most effective measure in preventing dental caries.[12] Modification in the frequency and intake of sugary food may mitigate their effects on caries development.[22] Training of auxiliary personnel in implementing guidelines in caries prevention and management are also beneficial.[37,38]

The data were gathered from pretreatment records of patients from NCFPI. Unfortunately, the authors were unable to determine if these patients were new patients or former patients who already underwent other procedures at NCFPI. It would be helpful if they can be differentiated so that it can be ascertained if the current preventive programs are effective or not.

Children in this study were not randomly selected because it was not feasible. Another limitation is, since the data relied on existing records, the examiners who performed the charting were not calibrated, thus affecting the reliability of the results. The sample also represented a small segment of the population. However, these findings may shed light on the limited information available regarding CLP in the Philippines. In addition, these may provide baseline information in implementing an effective preventive program in decreasing caries prevalence in children with CLP.

Conclusion and Recommendations

The incidence and prevalence of caries in children with CL, CP and CLP who sought treatment at the NCFPI are quite high. In addition, there is an increase in caries index scores with increasing age. There are significant differences in caries index scores between CL and CP and between CL and CLP. Poor oral hygiene and the presence of other predisposing factors increase the susceptibility of such a population to the progression of caries. Among these predisposing factors are developmental anomalies and oral habits such as nighttime bottle feeding, thumb sucking and mouth breathing.

Since one of the goals of NCFPI is to provide holistic treatment for CLP patients, an aggressive caries preventive program is necessary to reduce caries prevalence and incidence. In order to lessen the dental treatment procedures for patients with CLP, there is a need to focus on primary intervention. A preventive program which would include dental consultation by the child's first birthday, supervised tooth brushing using fluoridated toothpaste, training of auxiliary personnel in implementing these guidelines and education of the parents/and or guardians regarding the importance and benefits of proper oral hygiene measures, fluoride use, control of oral habits, and diet modification are all beneficial and necessary.

The sample population of the present study consisted only of patients from NCFPI, therefore the authors recommend that another study on a larger scale be carried out so that generalizations may be made to a larger group of those with clefts, from which new wide-ranging policies can be established.

Statement of Authorship
All authors have approved the final version submitted.

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