Dental Caries Experience, Treatment Needs, Dental Anomalies and Malocclusion in Preschool Children with Cleft Lip and/or Palate

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Background: *At present, little is known about the difference in caries experience in preschoolers with cleft lip/palate compared with the non-cleft children. Moreover, the studies regarding dental treatment needs, dental anomalies and malocclusion in these children are scarce.*
Objective: *To examine dental caries experience, treatment needs, dental anomalies, tooth malalignment and malocclusion in preschool children with cleft lip and/or palate at the Tawanchai Center of Cleft Lip-Cleft Palate and Craniofacial Deformities, Faculty of Medicine, Khon Kaen University.*
Material and Method: *Data were obtained from oral examination and medical records. Caries was diagnosed as decayed, missing, and filled primary teeth using the criteria of the World Health Organization with no radiographs. Type of dental treatment needs, dental anomalies, tooth malalignment and malocclusion were assessed.*
Results: *One hundred and twenty children whose mean age of 3.4 years fulfilled the inclusion criteria. There were 71 boys (59.2%) and 49 girls (40.8%). Majority (70%) of the children had cleft lip and palate. The caries prevalence was 83.3% with the mean decayed, missing, and filled teeth of 8.78. There were 98 children (81.7%) who needed some types of invasive dental treatment. High prevalence of dental anomalies, malalignment and malocclusion were also found in 24.2%, 58.3% and 86.7% of the sample, respectively. The children in cleft lip and palate group exhibited significant higher prevalence of caries experience (86.9% vs. 78.9%, 70.6%), and malocclusion (94.0% vs. 68.4%, 70.6%) and required more treatment needs (85.7% vs. 78.9%, 64.7%) than children in cleft palate and cleft lip groups.*
Conclusion: *This study indicates that cleft children have high caries prevalence and highly required dental treatment which greatly increase in prevalence and complexity after 2 years of age. Moreover, they also presented high prevalence of dental anomalies, tooth malalignment and malocclusion. Therefore, oral health promotion, prevention and early intervention are of importance and should be established at an early age.*

Keywords: *Cleft lip and/or palate, Dental caries, Treatment needs, Dental anomalies, Malocclusion*

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Cleft lip and/or palate are among the most common congenital anomalies[1]. The prevalence varies by ethnicity, country, and socioeconomic status. In Thailand, the overall birth incidence, recently reported, was 1.51 per 1,000 live births with higher incidence of 1.66 for Khon Kaen[2]. These patients require complicated medical and dental care from multi-disciplinary team during their first two decades of life.

Children with cleft lip and/or palate have a higher prevalence of dental anomalies which increase with the severity of cleft[3]. These children also present high prevalence and severity of malocclusion which can be assessed in early stages of dental development[4]. The irregularity of teeth and malocclusion in cleft children have been considered as predisposing factors for dental caries. While several studies reported that children with cleft lip and/or palate

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have an increased risk for caries, particularly in the primary dentition[5-7], a systematic review of case-control studies by Hasslof and Twetman could not find firm evidence to confirm this risk[8]. Furthermore, little information is available regarding dental treatment needs in cleft preschoolers.

The purpose of this study was to investigate the dental caries, dental treatment needs, dental anomalies and malocclusion in preschoolers with cleft lip and/or palate in the northeastern Thailand.

Material and Method

This descriptive cross-sectional study was approved by the Khon Kaen University Ethics Committee for Human Research (HE551199). The participants were dentate children with non-syndromic cleft lip and/or palate, aged up to 6 years, who registered at the Tawanchai Center of Cleft Lip-Cleft Palate and Craniofacial Deformities, Faculty of Medicine, Khon Kaen University, during August to December 2012. Exclusion criteria were those with systemic diseases or other deformities, those having severe uncooperative behaviors or having permanent teeth. Written informed consent was obtained from the parent prior to dental examination.

Each child was examined in knee-to-knee approach by one examiner, using a mouth mirror and periodontal probe with visual and non-tactile technique, with no radiographic examination due to the ethical concern. Cleft type was detected by oral examination and medical records and classified into 3 groups: 1) cleft lip (with or without alveolar cleft); 2) cleft palate; and 3) cleft lip and palate. Caries status in the primary dentition was diagnosed yielding decayed, missing, and filled teeth (dmft) index according to the criteria of the World Health Organization[9]. Types of dental treatments were recorded for each unsound tooth, according to the standard treatment plan of Department of Pediatric Dentistry, Khon Kaen University. These were classified as follows: No treatment required: tooth which required no treatment, but might require preventive care; Filling: carious tooth which required one- or two-surface restoration; SSC: carious tooth which required stainless steel crown restoration; Pulp treatment: carious tooth which required any type of pulp treatment; and Extraction: carious tooth which needed to be removed.

Dental anomalies, tooth alignment, overbite, overjet as well as molar and canine relationships were examined. Occlusion was defined as normal if 1) molar relationship was straight terminal plane or mesial-step, 2) canine relationship was Class I, 3) overbite and overjet were within 2 mm, and 4) no tooth malalignment was found. Otherwise, malocclusion would be defined.

The Statistical Package for the Social Sciences (SPSS) for Windows version 19.0 was used to analyze descriptive and analytical statistics. The descriptive statistics included percentage, mean, median and standard deviation. The analytical statistics comprised of Chi-square or Fisher's exact test for categorical data, one-way ANOVA for continuous data, and multiple comparison with Bonferroni adjustment. Significance was established at p-value <0.05. The kappa coefficient, recommended by Landis and Koch[10], was used to measure the intra-examiner reproducibility.

Results

After examining 182 children, 120 of them met the inclusion criteria. There were 71 (59.2%) boys and 49 (40.8%) girls. More males were found in cleft lip (10 boys: 7 girls) and cleft lip & palate (55 boys: 29 girls) groups, while more females presented in cleft palate (6 boys: 13 girls) group. The children's age ranged from 1.05 to 5.95 years with the mean, median, and standard deviation of 3.40, 3.35 and 1.45 years, respectively. As presented in Table 1, the majority of children (n = 84, 70%) had cleft lip and palate, followed by cleft palate (n = 19, 15.8%) and cleft lip (n = 17, 14.2%), respectively. The distribution of children in different age groups was comparable. The kappa coefficient for diagnosis of dental caries, dental anomalies, malalignment and malocclusion ranged from 0.86 to 0.93, indicating high intra-examiner reproducibility.

Table 2 shows that 100 (83.3%) of the participants had past caries experience with the mean dmft and SD of 8.78±6.8 and the value ranging from 0 to 20. The number of children having dental caries increased twice after 2 years old. The mean dmft of children in the age groups older than 2 years were 4 to 7 times higher (p<0.001) than those aged ≤2 years. Additionally, statistically significant increased mean dmft was also found in the participants aged >5 years (p<0.01) when compared to those aged up to 2 to 3 years.

With respect to cleft types, the cleft lip group had the lowest percentage of children having dental caries (Table 3). The mean dmft of cleft lip group was statistically significant lower than those of the cleft palate and cleft lip and palate groups (p = 0.012). However, no statistically significant difference in mean dmft was found between the cleft palate and cleft lip and palate groups.

Table 1. Distribution of the children by cleft type and age group

Age group (years)	Cleft type			Total	
	Cleft lip (n)	Cleft palate (n)	Cleft lip and palate (n)	n	%
≤2	7	5	17	29	24.2
>2-3	0	6	19	25	20.8
>3-4	4	4	15	23	19.2
>4-5	4	2	20	26	21.7
>5	2	2	13	17	14.2
Total	17	19	84	120	100

Table 2. Dental caries experience of the cleft children in different age groups

Age group (years)	Children having caries		Mean			dmft*		Mean difference	95% CI
	n	%	d	m	f	Mean	SD		
≤2	13	44.8	1.97	0.03	0	2.00	3.17	Reference	
>2-3	24	96.0	8.20	0.08	0	8.28	6.13	6.28	2.04-10.52
>3-4	23	100	11.52	0.17	0.17	11.87	6.27	9.87	5.54-14.20
>4-5	23	88.5	8.88	1.00	0.77	10.65	6.24	8.65	4.46-12.85
>5	17	100	10.29	2.06	1.71	14.06	4.74	12.06	7.32-16.80
Total	100	83.3	7.78	0.57	0.44	8.78	6.80		

dmft = decayed, missing, and filled teeth
* $p<0.001$ (Multiple comparison with Bonferroni adjustment)

Table 3. Dental caries experience of the cleft children in different cleft types

Cleft type	Children having caries		Mean			dmft*		Mean difference	95% CI
	n	%	d	m	f	Mean	SD		
Cleft lip	12	70.6	3.35	0	0.65	4.00	4.26	Reference	
Cleft palate	15	78.9	8.37	0.89	0.16	9.42	7.80	5.42	0.09-10.75
Cleft lip and palate	73	86.9	8.54	0.61	0.46	9.61	6.65	5.61	1.36-9.85
Total	100	83.3	7.78	0.57	0.44	8.78	6.80		

d = decayed teeth, m = missing teeth, f = filled teeth, dmft = decayed, missing, and filled teeth
* $p = 0.001$ (Multiple comparison with Bonferroni adjustment)

Of the 120 children, 98 (81.7%) required some types of invasive dental treatment with the mean of 3.78±3.33, 1.98±2.88, 0.47±0.97, and 1.53±2.72 for filling, SSC, pulp treatment and extraction, respectively (Table 4). When compared with the participants aged group of ≤2 year (44.8%), the children in all older age groups needed treatment approximately 2 times more. Higher number of teeth requiring treatment and more invasive treatment also increased with age. The higher age group tended to have more tooth loss than the younger one. The treatment needs either by percentage or by number of teeth was highest in the cleft lip and palate group, followed by cleft palate group and the cleft lip group. The cleft palate and cleft lip and palate groups required more invasive treatment than the cleft lip group.

Table 4. Dental treatment needs by age group and cleft type

	The children requiring treatment		Treatment type			
	n	%	Filling (teeth) Mean ± SD	SSC (teeth) Mean ± SD	Pulp treatment (teeth) Mean ± SD	Extraction (teeth) Mean ± SD
Age group (years)						
≤2	13	44.8	1.69±2.67	0.21±0.56	0	0.07±0.26
2 to 3	24	96.0	4.08±3.29	2.56±3.19	0.28±0.68	1.28±2.30
3 to 4	23	100.0	5.74±3.29	2.65±2.57	0.96±1.52	2.13±2.65
4 to 5	22	84.6	3.69±2.75	3.12±3.98	0.58±0.99	1.50±2.01
>5	16	94.1	4.41±3.59	1.53±1.63	0.71±0.85	3.65±4.65
Cleft type						
Cleft lip	11	64.7	2.47±2.76	0.47±1.07	0.18±0.53	0.24±0.97
Cleft palate	15	78.9	3.84±4.25	2.42±3.12	0.89±1.63	1.21±2.30
Cleft lip and palate	72	85.7	4.04±3.18	2.19±3.00	0.43±0.81	1.87±2.96
Total	98	81.7	3.78±3.33	1.98±2.88	0.47±0.97	1.53±2.72

Table 5. Prevalence of dental anomalies and tooth malalignment by cleft type

Cleft type	Dental anomalies*		Tooth malalignment**	
	n (%)	OR (95% CI)	n (%)	OR (95% CI)
Cleft lip	5 (29.4)	9.53 (1.18, inf)	12 (70.6)	20.40 (3.38, 123.25)
Cleft palate	0 (0)	1	2 (10.5)	1
Cleft lip and palate	24 (28.6)	10.40 (1.68, inf)	56 (66.7)	17.00 (3.67, 78.81)
Total	29 (24.2)		70 (58.3)	

* $p = 0.012$ (Fisher's exact test), ** $p<0.001$ (Chi-square test)

Table 6. Prevalence of malocclusion and cross bite by cleft type

Cleft type	Malocclusion*		Anterior cross bite**		Posterior cross bite***	
	n (%)	OR (95% CI)	n (%)	OR (95%CI)	n (%)	OR (95% CI)
Cleft lip	12 (70.6)	1.11 (0.27, 4.60)	3 (18.8)	1	2 (14.3)	2.58 (0.12, 166.97)
Cleft palate	13 (68.4)	1	8 (47.1)	3.85 (0.80, 18.62)	1 (5.9)	1
Cleft lip and palate	79 (94.0)	7.29 (1.94, 27.40)	61 (84.7)	24.03 (5.87, 98.43)	38 (48.7)	14.89 (2.11, 653.81)
Total	104 (86.7)		72 (68.6)		41 (37.6)	

* $p = 0.001$ (Fisher's exact test), ** $p<0.001$ (Chi-square test), *** $p<0.001$ (Fisher's exact test)

Table 5 demonstrates that 29 (24.2%) of the cleft children presented some types of dental anomalies which included hyperdontia (n = 18), microdontia (n = 4), macrodontia (n = 7), double tooth (n = 4), and enamel hypoplasia or hypomineralization (n = 3). The children with cleft lip and cleft lip and palate had significant higher tooth anomalies (9.53 to 10.40 times) than those with cleft palate ($p = 0.012$). Malalignment of teeth were found in 58% (70) of the children. Significant higher tooth malalignment (17.00 to 20.40 times) presented in the cleft lip and cleft lip and palate groups when compared with the cleft palate group ($p<0.001$).

As shown in Table 6, prevalence of malocclusion was 86.7%. The cleft lip and palate group presented 7.29 times malocclusion significantly higher than the cleft lip and the cleft palate groups ($p = 0.001$). Of the 120 children, 68.6% had anterior crossbite and 37.6% presented posterior crossbite. In addition, the most frequently affected group was cleft lip and palate.

Discussion

Regarding to gender distribution, the findings in this present study confirm those of Watkins et al who reported that cleft lip is about twice more common in males than females whereas isolated cleft palate is more common in the females[11]. Among the sample examined, much more percentage of the children had past caries experience (100 of 120; 83.3%). This pattern was seen across all age ranges, except for those age group of ≤2-years (44.8%). The percentage of children with caries in this present study is higher than those reported in the 7th Thailand National Oral Health Survey, at 51.7% for 3- and at 78.5% for 5-year-old children[12]. The mean dmft of 8.28 and 10.65 for the groups aged >2 to 3 years and >4 to 5 years, respectively, was twice greater than the average dmft score of 2.7 and 4.4, respectively in the same report[12]. Nonetheless, the mean dmft of cleft children in the present study (8.78) was comparable to the dmft of 9.19 reported in the southern Thai cleft children, aged 18 to 36 months[13] but higher than those of other cleft populations[6,14-18]. This may be due to the different criteria for caries assessments, oral health behaviors and cultural differences of the populations.

In the present study, the prevalence of dental caries and the number of carious teeth obviously increased from 44.8% and dmft of 2.0 for the group aged ≤2 years, to 100.0% and dmft of 14.06 for the group aged <5 years. This finding is similar to the study of Paul and Brandt who reported the mean dmfs of 1.9 for the 3 to 5 year-old children that increased to be 2.8 for the 6 to 12 year-old children. In spite of the fact that caries is cumulative with age, the significant increase of caries prevalence to almost 100% after the age of 2 years in the present study suggests the importance of early implementation of prevention and therapeutic dental care for these cleft preschoolers. A healthy primary dentition is essential to maintain oral function and arch space for future permanent dentition[19].

Apart from age of children, prevalence of dental caries in primary dentition is also associated with severity of the cleft defect. The children with cleft lip and palate and those with cleft palate in this present study showed significant more caries experience than those with cleft lip. This result is similar to most published studies[18,20-21] although a few studies reported otherwise. Ankola et al found that cleft children had high dental caries experience (dmft 3.95-6.57) irrespective of the age groups[18]. Similarly, Dahllof et al could not find significant difference in caries experience among various cleft types[6].

Investigation assessing dental treatment needs in cleft children is negligible. This, partly, may be due to the lack of agreeable criteria among professionals to determine the dental treatment needs. Since radiographic examination was not used in this present study, the decision for choosing treatment type might not be precise. However, these data remain crucial for the organization, in terms of management of financial support and man-power. The number of patients, including teeth that were left untreated in these cleft preschoolers could help raising awareness of their oral health status to the interdisciplinary team. Number of untreated teeth in the studied sample were distinctly higher than the National average[12]. Additionally, more invasive dental treatments were indicated for the cleft untreated teeth. In the 3-year-old group, the requirement for SSC was 8 times more than the National average of the corresponding age group, and 5 times more untreated teeth needed extraction at the age of 3 and 5 years old. The older the age group, the higher numbers of treatment needs and more invasive treatment. Prevalence of untreated teeth and complexity of treatment type were highest in the cleft lip and palate group and lowest in the cleft lip group. These findings agree with those of Ankola et al who reported increased treatment needs in children with more severe cleft defects[18].

In this present study, dental anomalies were manifested in a quarter of the sample. The most prevalent dental anomaly was a maxillary supernumerary tooth which was found in 15% of the sample (18/120). The present result is similar to that reported by Vallino et al who concluded that a maxillary supernumerary tooth was the most frequently occurring dental anomaly in children with cleft lip only[22]. Differed from previous studies on the prevalence of congenitally missing primary teeth[6,23], it is surprising that hypodontia was not found in this study. These findings might have been underestimated because radiographic examination was not used and aberrations in permanent teeth were not assessed. In addition, some supernumerary teeth could have been removed during surgical repair of the cleft. The

significant higher dental anomalies in the cleft lip and cleft lip and palate groups, compared to the cleft palate group suggests the prominent influence of cleft lip.

The children in the present study exhibited high prevalence of malocclusion (86.7%), a finding that is consistent with that reported by others[4,24-26]. However, most of those reports were conducted in the mixed and permanent dentition. The most common malocclusion in this present report was anterior and posterior crossbite, occurring in 68.6% and 37.6%, respectively. This rate is higher than previous studies in primary dentition[4,23]. In spite of the small number of children in cleft lip and cleft palate groups, the cleft lip and palate group had significantly higher malocclusion than other cleft types.

Some limitations of this present study should be mentioned. Firstly, radiographic examination was not used. This may result in an underestimation of caries experience and prevalence of dental anomalies, as well as the accuracy of decision for dental treatment type. Secondly, the small number of children, available in cleft lip and cleft palate groups, may affect the statistic outcomes. Future studies which employ radiographic assessment and include larger sample size should be considered.

Conclusion

The present study suggested that the northeastern Thai cleft children aged up to 6 years obviously had high prevalence of dental caries, dental anomalies, tooth malalignment and malocclusion in their primary dentition. The prevalence of dental caries dramatically increased and more complicated type of dental treatment after 2 years of age. The children with cleft lip and palate presented significant higher prevalence of caries experience, dental anomalies and malocclusion than children in other cleft types. More dental treatment needs were also found in the cleft lip and palate group. These findings indicate that pre-school children with cleft lip and/or palate should be provided with a preventive and therapeutic dental care at early age. Therefore, their primary dentition can be preserved healthy, thereby facilitating subsequent surgical correction and orthodontic therapy.

What is already known on this topic?

Cleft children are at risk for dental caries, dental anomalies and malocclusion. However, the information regarding to these problems in preschoolers having cleft lip/palate has been inadequate and inconsistent. Little has been reported about dental treatment needs in these children.

What this study adds?

The present study showed high prevalence of dental caries, dental anomalies, tooth malalignment and malocclusion in preschoolers with cleft lip/palate, especially the children in cleft lip and palate group. The cleft children in the northeastern region had much higher caries prevalence and dental treatment needs than general Thai children. These results should be considered in a comprehensive treatment plan for these children.

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Potential conflicts of interest

None.

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ประสบการณ์ฟันผุความจำเป็นในการรักษาทางทันตกรรมความผิดปกติของฟันและการสบฟันที่ผิดปกติในเด็กก่อนวัยเรียนที่ปากแหว่งและ/หรือเพดานโหว่

จินดา เลิศศิริวรกุล, นัดดา ขจรไชยวุฒิ, ปฏิมาพร พึ่งชาญชัยกุล, สุบิน พัวศิริ, สุทิน จินาพรธรรม

ภูมิหลัง: *ปัจจุบันความชุกของโรคฟันผุในเด็กก่อนวัยเรียนที่ปากแหว่งเพดานโหว่เมื่อเปรียบเทียบกับเด็กปกติ ยังไม่เป็นทราบกันมากนัก นอกจากนี้การศึกษาเกี่ยวกับความจำเป็นในการรักษาทางทันตกรรม ความผิดปกติของฟันและการสบฟันที่ผิดปกติในเด็กกลุ่มนี้ยังมีน้อย*

วัตถุประสงค์: *เพื่อศึกษาประสบการณ์ฟันผุ ความจำเป็นในการรักษาทางทันตกรรม ความผิดปกติของฟัน การเรียงตัวของฟันที่ผิดปกติและการสบฟันที่ผิดปกติในเด็กก่อนวัยเรียนที่ปากแหว่งและ/หรือเพดานโหว่ที่ศูนย์ตะวันฉาย เพื่อการดูแลผู้ป่วยปากแหว่งเพดานโหว่และความพิการแต่กำเนิดของศีรษะและใบหน้า คณะแพทยศาสตร์ มหาวิทยาลัยขอนแก่น*

วัสดุและวิธีการ: *ทำการเก็บข้อมูลโดยการตรวจสภาวะช่องปากเด็กและจากบันทึกทางการแพทย์ การวินิจฉัยฟันผุ ใช้ดัชนีซี่ฟันผุ อุด ถอนตามเกณฑ์ขององค์การอนามัยโลก โดยไม่มีการตรวจด้วยภาพรังสี มีการประเมินชนิด ของการรักษาทางทันตกรรม ความผิดปกติของฟันความผิดปกติของการเรียงตัวของฟัน และการสบฟันที่ผิดปกติ*

ผลการศึกษา: *กลุ่มศึกษาที่ผ่านเกณฑ์คัดเข้ามีจำนวน 120 คน อายุเฉลี่ย 3.4 ปี เป็นชาย 71 คน (ร้อยละ 59.2) และหญิง 49 คน (ร้อยละ 40.8) เด็กส่วนใหญ่มีภาวะปากแหว่งและเพดานโหว่ (ร้อยละ 70) กลุ่มศึกษามีความชุกของการเกิดฟันผุในชุดฟันน้ำนมร้อยละ 81.7 โดยมีค่าเฉลี่ยฟันผุ ถอน อุด เท่ากับ 8.78 ซี่ต่อ มีเด็ก 98 คน (ร้อยละ 81.7) ที่ต้องการการรักษาทางทันตกรรมที่รุกรานแบบใดแบบหนึ่ง พบความผิดปกติของฟัน ความผิดปกติของการเรียงตัวของฟัน และการสบฟันที่ผิดปกติในเด็กร้อยละ 24.2, 58.3 และ 86.7 ตามลำดับ เด็กในกลุ่มปากแหว่ง และเพดานโหว่มีความชุกของฟันผุ (ร้อยละ 86.9 เปรียบเทียบกับ ร้อยละ 78.9, ร้อยละ 70.6) และการสบฟันที่ผิดปกติ (ร้อยละ 94.0 เปรียบเทียบกับ 68.4, ร้อยละ 70.6) มากกว่า และต้องการการรักษาทางทันตกรรม (ร้อยละ 85.7 เปรียบเทียบกับ 78.9, ร้อยละ 64.7) มากกว่าเด็กในกลุ่มเพดานโหว่และกลุ่มปากแหว่งอย่างมีนัยสำคัญทางสถิติ*

สรุป: *การศึกษานี้ชี้ให้เห็นว่าเด็กปากแหว่งเพดานโหว่มีความชุกของโรคฟันผุที่สูง และต้องการการรักษาทางทันตกรรมมาก ซึ่งเพิ่มขึ้นอย่างชัดเจนทั้งความชุกและความซับซ้อนของการรักษาหลังจากอายุ 2 ปี นอกจากนี้เด็กเหล่านี้ ยังมีความชุกของความผิดปกติของฟัน ความผิดปกติของการเรียงตัวของฟัน และการสบฟันที่ผิดปกติมาก ดังนั้นการส่งเสริมสุขภาพช่องปาก การป้องกัน และการรักษาแต่เนิ่น ๆ จึงเป็นสิ่งสำคัญและควรเริ่มตั้งแต่อายุยังน้อย*