Prevalence and Characteristics of Dental Anomalies in Pediatric Patients at a Dental Hospital in Thailand

Ruedee Sakulratchata*, Sasipa Wongma, Sita Saenmood, Thunyanut rianpingwang and Sasicha Chiohanangkun

Department of Preventive Dentistry, Faculty of Dentistry, Naresuan University, Phitsanulok, 65000, Thailand

* Corresponding author. E-mail address: ruedees@nu.ac.th

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Abstract

This retrospective study was performed by collecting data from dental records of 385 pediatric patients who had a complete dental examination and treatment planning at Dental Hospital in Phitsanulok, Thailand, during the period of January 1, 2014 – December 31, 2017. The objective of this study is to evaluate the prevalence and characteristics of the most frequently found dental anomalies. The results show that the prevalence of dental anomaly in pediatric patients is 13.25%. The most prevalent anomalies are congenital missing teeth (34.38%), supernumerary teeth (20.31%), embedded teeth (9.38%), enamel hypoplasia (7.81%), and others (1.56%-6.25%). A chi-square test revealed a significant relationship between child age and dental anomaly (P=0.001), in which dental anomaly prevalence is higher in children age 6-12 than in children age 0-5. No significant relationship existed between dental anomaly and sex, systemic disease, or physiological/psychological disorder (P>0.05). The most common disorder associated with dental anomaly was "cleft lip with cleft palate", and the most common anomaly associated with that disorder was congenital missing permanent anterior maxillary teeth.

Keywords: dental anomalies, pediatric, prevalence, congenital missing teeth, supernumerary teeth

Introduction

Dental anomalies are a broad spectrum of tooth alternations and can be categorized into 2 major groups which are developmental and acquired dental anomalies (Neville, Damm, Allen, & Chi, 2009). Congenital abnormalities were included abnormalities in number, size, shape, or structure of teeth (Shokri, Mortazavi, Baharvand, & Movahhedian, 2015). Dental anomalies which occur during tooth development include anodontia, double teeth, dens invaginatus, dilacerations. Those which take place during the tooth eruption process include ectopic eruption, impaction, and embedded teeth (Bailit, 1975). Dental anomalies can be found both in primary dentition and permanent dentition. Some dental anomalies do not cause any problem but some of them do. Such complications can affect esthetics, occlusion, or phonetics with varying levels of severity. Previous literature has found the prevalence of dental anomaly in primary dentition to be 2-5% (Chen, Cheng, Wang, & Yang, 2010; Deolia, Chhabra, Chhabra, Kalghatgi, & Khandelwal, 2015; Shilpa, Gokhale, Mallineni, & Nuvvula, 2017). The prevalence rises to 20-31% when studies include older children with mixed dentition (Singhal et al., 2017; Temilola et al., 2014; Wangsrimongkol, Manosudprasit, Pisek, & Chittiwatanapong, 2013; Yassin, 2016). The most common dental anomalies in primary dentition are double teeth (fusion) and hypodontia (missing tooth) (Chen et al., 2010; Deolia et al., 2015; Kapdan, Kustarci, Buldur, Arslan, & Kapdan, 2012; Kramer, Feldens, Ferreira, Spiguel, & Feldens, 2008; Shilpa et al., 2017; Wangsrimongkol et al., 2013; Yassin, 2016; Yonezu, Hayashi, Sasaki, & Machida, 1997). In mixed dentition, the most commonly reported dental anomalies are enamel hypoplasia (Basalamah & Baroudi, 2016; Singhal et al., 2017; Temilola et al., 2014), impacted tooth (Kathariya et al., 2013; Shokri, Poorolajal, Khajeh, Faramarzi, & Kahnamoui, 2014), dilaceration

(Tantanapornkul, 2015), and hypodontia (Yassin, 2016). The differences in prevalence and characteristics of dental anomalies found among different studies can come from variation in population, data collection methods, inclusion/exclusion criteria, etc. The prevalence of dental anomalies varies between different ethnicities, gender, age group and dentition. Children with specific syndromes or underlying diseases are associated with some dental anomalies such as microdontia in Down syndrome as well as missing tooth in cleft palate patients (Puranik & Gandhi, 2019). Different survey conditions also affect the prevalence of dental anomalies which clinical examination with radiograph in dental clinic setting provide better information than a field survey or clinical investigation alone.

There have been few published studies on the prevalence of dental anomalies in Thailand. The limited existing studies involve only a specific group of children (such as orofacial cleft) (Wangsrimongkol et al., 2013) or were performed prior to 1976 (Intaraprasong, Puanaiyaka, & Wattanasandaporn, 1983). This study therefore provides an updated evaluation of the prevalence and characteristics of dental anomalies in pediatric patients in Phitsanulok, Thailand.

Methods and Materials

The present study is a retrospective study performed by collecting oral examination data and dental radiographic data from patient records. All subjects were Thai pediatric patients age 0-5 years (primary dentition) and 6-12 years (mixed dentition) who came to the Pediatric Dental Clinic of Naresuan University Dental Hospital, Phitsanulok from January 1, 2014 to December 31, 2017. The sample size was calculated from the prevalence of related previous studies which conducted in Asian populations (Tantanapornkul, 2015). Based on the estimated sample size of 194 from the calculation, the required samples of this study were set at 200. Systematic sampling was used to randomly select the required samples from total patient list. The first sample was chosen by a random number table, then every 5th patient record was selected. Patients who experienced jaw fracture that might affect the normal growth of teeth or trauma that caused loss of at least one tooth were excluded. This study was reviewed and approved by the Research Ethics Committee of Naresuan University (Ethical approval number 0434/61). Five data collectors discussed and agreed upon methodology for data collection and extraction, and carried out intra- and inter-examiner calibrations with a kappa coefficient not less than 0.8. Each patient's records, including any radiographic data, were reviewed first by two examiners, who were fifth year dental students, and then by one principal investigator, who was a pediatric dentist. Patient demographic data collected consisted of age, sex, race, and residence (city and province). Each patient's medical problems, hereditary conditions, and physiological/psychological disorders were also recorded. The dental anomaly records consisted of dental abnormalities in number, size, shape, position, and structure. All data was recorded in a detailed data collection form.

Statistical analysis used:

Descriptive statistic was used to evaluate the prevalence and distribution of dental anomalies and other finding. Frequencies and percentages were also calculated. The data was statistically analyzed using the chi-square test and other features of SPSS software (IBM, version 17.0)

Results

The prevalence of dental anomaly in the total of 385 pediatric patients from this study was 13.25%. There is no statistical difference in dental anomaly prevalence between boys (7.01%) and girls (6.24%), however statistical difference was found between the two age groups. Children in the age 6-12 group had a significantly higher prevalence of dental anomalies (9.61%) than did the age 0-5 group (3.64%) (p=0.001). There is no significant difference in dental anomaly prevalence between children with underlying disease (6.23%) and without underlying disease (7.02%). (Table 1)

More dental anomalies were found in the maxilla alone (62.75%) than in the mandible alone (27.45%) or in both maxilla and mandible (9.80%), and more anomalies appeared unilaterally (78.43%) than bilaterally (27.45%). Regarding the frequency of dental anomalies, single dental anomalies occurred more frequently than either two or more than two dental anomalies. (Table 2)

Table 1 Prevalence of dental anomalies in 385 Thai pediatric patients

Variable	Number of Children		P-value
	with dental anomalies	without dental anomalies	
Total	51 (13.25%)	334 (86.75%)	0.848
Male	27 (7.01%)	172 (44.68%)	
Female	24 (6.24%)	162 (42.08%)	
Age			**0.001**
0-5 years	14 (3.64%)	171 (44.42%)	
6-12 years	37 (9.61%)	163 (42.34%)	
Underlying disease			0.095
With underlying disease	23 (5.97%)	94 (24.42%)	
Without underlying disease	28 (7.27%)	240 (62.34%)	

In this study, children with systemic diseases, syndromes, or physiological/psychological disorders were all considered "children with underlying diseases". The main underlying diseases encountered with dental anomalies in this study were hypopituitarism, thrombocytopenia, congenital heart disease, thalassemia, Down's syndrome, respiratory distress syndrome, and cleft lip and/or palate. The frequency of each dental anomaly encountered in children with underlying disease is shown in Table 3.

Table 2 Distribution and frequency of dental anomalies

Dental arch with dental anomalies	N (%)
Maxilla	32 (62.75%)
Mandible	14 (27.45%)
Maxilla and Mandible	5 (9.80%)
Arch side of dental anomalies	**N (%)**
Unilateral	40 (78.43%)
Bilateral	11 (21.57%)
Frequency of dental anomalies	**N (%)**
Children with 1 dental anomaly	38 (74.50%)
Children with 2 dental anomalies	10 (19.61%)
Children with > 2 dental anomalies	3 (5.89%)

Patients with "cleft lip and palate" had the highest frequency of dental anomalies among patients with underlying diseases. In the cleft lip and palate children, congenital missing tooth was the most common dental anomaly. (Table 3)

The distribution of dental anomalies grouped by type is shown in Table 4. Anomalies of number in general and congenital missing tooth in particular, are the most common dental anomalies in this this study's patients. Among the anomalies of position, embedded tooth was found more frequently than other anomalies of position. Looking at the dental anomalies of shape, microdontia had the highest prevalence in this group. Enamel hypoplasia was the only instance of structural anomaly found in this study.

Table 3 Frequency of dental anomalies in children with systemic diseases, syndromes, or physiological/ psychological disorders

Underlying disease/ condition	Number of Children								
	With dental anomalies							Without anomalies	Total
	Congenital missing	Supernumerary tooth	Natal tooth	Enamel hypoplasia	Embedded tooth	Microdontia	Total		
Cleft lip and palate	8	2	–	1	1	–	12	11	23
Congenital heart	1	–	–	1	3	–	5	11	16
Down's syndrome	1	–	–	–	–	–	1	3	4
Respiratory distress	–	–	1	–	–	–	1	–	1
Cleft lip	–	1	–	–	–	–	1	1	2
Thalassemia	–	–	–	1	–	–	1	–	1
Hypopituitarism	–	–	–	–	–	1	1	–	1
Thrombocytopenia	–	1	–	–	–	–	1	–	1
Other systemic	–	–	–	–	–	–	–	68	68
Total	10	4	1	3	4	1	23	94	117

* Other systemic diseases/ syndromes and physiological/ psychological disorders including renal disease, asthma, delayed development, visual impairment, SLE, systemic juvenile idiopathic arthritis, G6PD deficiency, epilepsy, Pierre Robin syndrome, Leigh syndrome, Prader-Willi syndrome, Freeman Sheldon syndrome, Patau syndrome, cleft palate, attention deficit hyperactive disorder, autism

Table 4 Dental anomaly distribution according to type, sex, and age

Dental anomaly	N (%)					
	Sex			Age (yrs.)		
	Male	**Female**	**Total**	**0 – 5**	**6 – 12**	**Total**
Number anomalies:	**25 (37.9%)**	**15 (22.7%)**	**40 (60.6%)**	**11 (16.7%)**	**29 (43.9%)**	**40 (60.6%)**
Supernumerary tooth	10 (15.2%)	4 (6.1%)	14 (21.2%)	2 (3.0%)	12 (18.1%)	14 (21.2%)
Congenital missing tooth	13 (19.7%)	10 (15.1%)	23 (34.8%)	8 (12.1%)	15 (22.7%)	23 (34.8%)
Odontoma*	1 (1.5%)	1 (1.5%)	2 (3.0%)	0	2 (3.0%)	2 (3.0%)
Natal tooth	1 (1.5%)	0	1 (1.5%)	1 (1.5%)	0	1 (1.5%)
Position anomalies:	**6 (9.1%)**	**6 (9.1%)**	**12 (18.2%)**	**1 (1.5%)**	**11 (16.7%)**	**12 (18.2%)**
Ectopic eruption	2 (3.0%)	2 (2.9%)	4 (6.1%)	1 (1.5%)	3 (4.5%)	4 (6.1%)
Impacted tooth	2 (3.0%)	0	2 (3.0%)	0	2 (3.0%)	2 (3.0%)
Embedded tooth	2 (3.0%)	4 (6.1%)	6 (9.1%)	0	6 (9.1%)	6 (9.1%)
Shape anomalies:	**2 (3.0%)**	**7 (10.6%)**	**9 (13.6%)**	**3 (4.5%)**	**6 (9.1%)**	**9 (13.6%)**
Fusion	0	1 (1.5%)	1 (1.5%)	1 (1.5%)	0	1 (1.5%)
Taurodontism	0	1 (1.5%)	1 (1.5%)	1 (1.5%)	0	1 (1.5%)
Microdontia	1 (1.5%)	3 (4.5%)	4 (6.1%)	1 (1.5%)	3 (4.5%)	4 (6.1%)
Dilaceration	0	1 (1.5%)	1 (1.5%)	0	1 (1.5%)	1 (1.5%)
Dens evaginatus	1 (1.5%)	0	1 (1.5%)	0	1 (1.5%)	1 (1.5%)
Febrile illness**	0	1 (1.5%)	1 (1.5%)	0	1 (1.5%)	1 (1.5%)

Table 4 (Cont.)

Dental anomaly	N (%)					
	Sex			Age (yrs.)		
	Male	**Female**	**Total**	**0 – 5**	**6 – 12**	**Total**
Structure anomalies:						
Enamel hypoplasia	**2 (3.0%)**	**3 (4.5%)**	**5 (7.6%)**	**1 (1.5%)**	**4 (6.1%)**	**5 (7.6%)**
Total	**35 (53.0%)**	**31 (47.0%)**	**66 (100%)**	**16 (24.2%)**	**50 (75.8%)**	**66 (100%)**

*(Satish, Prabhadevi, & Sharma, 2011), **(Nanci, 2013)

Table 5 shows that the majority of congenital missing teeth anomalies were found in permanent dentition, mostly in the anterior region. The position of the missing teeth was also more often in the maxilla and unilateral than in the mandible or bilateral. Supernumerary teeth anomalies (Table 6) and congenital missing teeth (Table 5) both occurred most frequently in the maxilla and permanent dentition, with this tendency particularly pronounced in the supernumerary teeth. Supernumerary teeth were most frequently located between the upper central incisors and had already erupted into the oral cavity.

Table 5 Distribution and characteristics of congenital missing teeth

Characteristics	N	Percentage
Gender:		
Male	13	56.52
Female	10	43.48
Arch :		
Maxilla	15	65.22
Mandible	7	30.43
Maxilla and mandible	1	4.35
Side:		
Unilateral	13	56.52
Bilateral	10	43.48
Location:		
Primary		
Anterior tooth	4	17.39
Posterior tooth	0	0
Anterior and posterior tooth	0	0
Permanent		
Anterior tooth	10	43.48
Posterior tooth	8	34.78
Anterior and posterior tooth	0	0
Primary and Permanent		
Anterior tooth	1	4.35
Posterior tooth	0	0
Anterior and posterior tooth	0	0

Table 6 Distribution and characteristics of supernumerary teeth

Characteristics	Count	Percentage
Sex :		
Male	10	71.43
Female	4	25.57
Arch :		
Maxilla	12	85.71
Mandible	2	14.29

Table 6 (Cont.)

Characteristics	Count	Percentage
Side :		
Unilateral	13	92.86
Bilateral	1	7.14
Location :		
Permanent anterior area	2	14.29
Permanent posterior area	1	7.14
Permanent anterior and posterior area	1	7.14
Primary anterior area	1	7.14
Between position 11 and 21 (inclusive)	5	35.71
Palatal surface of permanent anterior area	4	28.57
Eruption :		
Erupted tooth	7	50.00
Partially erupted tooth	1	7.14
Unerupted tooth	5	35.71
Both erupted and unerupted (more than 1 tooth)	1	7.14

Discussion

This study provides an epidemiology of dental anomaly data in a group of Thai children, information which has been lacking for more than 40 years. This data can help dentists be aware of the dental anomalies that are most likely to be found in specific groups of children (e.g. by age) and where anomalies are most likely to be located (e.g. maxilla). This new data can also suggest new topics for further research. Since the treatments for some dental anomalies are quite complicated, sometimes requiring much time and input from several kinds of dental specialists, information on the prevalence and characteristics of dental anomalies as provided by this study can be useful for early detection of dental anomalies as well as for preparation of management plans and prevention of further complications.

This study found the prevalence of dental anomalies in pediatric Thai children age 0-12 years to be 13.25%. Similar studies of children in India, Yemen, Saudi Arabia, and Nigeria, had prevalences of 2.41, 15.1, 25.39, and 26.6%, respectively (Singhal et al., 2017; Temilola et al., 2014; Yassin, 2016). The variations in prevalence among the different studies may result from variations in patient races, data collection methods, and criteria for inclusion or exclusion. The present study found a higher prevalence of dental anomalies in children with mixed dentition than in children with primary dentition. This is consistent with studies by Basalamah and Baroudi (2016) Temilola et al. and Vaughan et al. (Temilola et al., 2014). The primary teeth developmental period was mainly occurred during the period of a gestation, while the formation of permanent teeth started after birth. The etiology of dental anomalies was believed to be from hereditary factors, acquired factors or both. This implies, disturbances in the developmental process of primary teeth would be mainly from genetic factors, but permanent tooth formation can be affected by both hereditary and environmental factors. Developmental periods of permanent teeth also take longer time than those of primary teeth. Moreover, most types of dental anomalies in primary dentition have been exhibited a correlation with anomalies in permanent dentition because permanent teeth develop from the successional dental lamina associated with the primary tooth germs. Thus dental anomalies which were found in primary teeth, usually present in the succedaneous teeth as well. There is no statistical difference in dental anomaly prevalence between the sexes. That same result was also reported by numerous

other studies conducted in Asia. (Afify & Zawawi, 2012; Chen et al., 2010; Herrera-Atoche, DiaMorales, Colome Ruiz, Escoffie Ramirez, & Orellana, 2014).

Congenital missing tooth was found to be the most prevalent dental anomaly in the present study and other studies of children and adults in other countries of Asia, such as Saudi Arabia, the United Arab Emirates and Yemen (Basalamah & Baroudi, 2016; Yassin, 2016; Zakaria, Duarte, & Al Baloushi, 2018). On the other hand, studies in South Africa and Mexico had different results, with the most common dental anomaly being enamel hypoplasia and impacted tooth, respectively (Herrera-Atoche et al., 2014; Temilola et al., 2014). The study that revealed enamel hypoplasia as the most prevalent in children was conducted by Temilola et al. in Nigeria, in a suburban area where low birthweight and malnutrition were often observed. Perhaps importantly, Temilola's study looked for dental anomalies using only clinical examinations without the benefit of any radiographic data. That might have affected the results on the prevalence of dental anomalies. A study by Herrera-Atoche et al. (2014) of people of Mexican origin in Mexico showed a high prevalence of impacted teeth among patients with mixed and permanent dentition (Herrera-Atoche et al., 2014). This might be explained by a study conducted by Vela, Taylor, Campbell, and Buschang (2011) which found smaller craniofacial dimensions and larger teeth among Mexican American people compared to European American people. When there is not enough space for third molar eruption in the dental arch, the result is impaction of the third molar (Vela et al., 2011).

The majority of congenital missing teeth in the present study are permanent anterior teeth on a single side of the upper arch in males. These results are consistent with a study by Shilpa et al. except for the location of the missing teeth. Shilpa's study found a higher prevalence of missing teeth in the lower arch of Indian children than in the upper arch (Shilpa et al., 2017). A high prevalence of congenital missing tooth among upper permanent teeth was also reported in numerous studies involving cleft palate patients (Akcam, Evirgen, Uslu, & Memikoglu, 2010; Costa, Diniz, Lacerda, Forte, & Sampaio, 2012; Nicholls, 2016; Rullo et al., 2015; Wangsrimongkol et al., 2013). Defects of the alveolar bone and/or the palatal bone in patients with cleft palate often resulted in missing teeth in the cleft area. In the present study, children with cleft lip and palate had the highest prevalence of congenital missing permanent upper anterior teeth followed by supernumerary teeth, whether compared to children with other underlying disease or to children without underlying disease. Cleft palate in children often found in the premaxilla area which related to the location of the congenital missing tooth and supernumerary tooth, the two highest prevalence of dental anomalies in this current study. Supernumerary teeth result from fragmentation of the dental lamina during cleft formation while tooth agenesis in the cleft area may be resulted from a deficiency in blood supply, either congenital or secondary to surgery, or to a deficiency in the mesenchymal mass (Akcam et al., 2010; Garvey, Barry, & Blake, 1999; Kriangkrai et al., 2006). A high prevalence of congenital missing third molar teeth was reported from studies conducted in adult patients (Afify & Zawawi, 2012). Premolars were also reported frequently as congenital missing teeth in permanent dentition in multiple studies, although there were variations in location of the absent premolars and in the sex of the patient among the different studies (Nordgarden, Jensen, & Storhaug, 2003; Ramdurg, Mendegeri, Vanishree, Achanur, & Srinivas, 2016; Sheikhi, Sadeghi, & Ghorbanizadeh, 2012; Tantanapornkul, 2015). Congenital missing teeth can cause many sorts of difficulties including phonetic, esthetic, functional, and psychological issues. Early diagnosis and treatment of congenital missing teeth in children, especially in high risk groups such as children with cleft palate, can help preserve and improve orofacial function and also minimize serious complications.

Ideally pediatric dentists, orthodontists, and other dental specialists are able to work as a multidisciplinary team for careful examination and treatment of these children.

Supernumerary teeth, the second most common dental anomaly in this study, were frequently found between the upper central permanent incisors or on the palatal side of permanent anterior teeth. Most of the supernumerary teeth were either erupted or partially erupted. The generally preferred treatment for supernumerary teeth is to remove them from the dental arch (Garvey et al., 1999). Very few extra teeth can wait for removal or simply be monitored without removal. Timing of tooth removal is crucial, especially when extra teeth block the eruption of succedaneous teeth. Early detection and removal of supernumerary teeth can prevent delayed eruption or ectopic eruption of succedaneous teeth underneath (Mallineni, 2014). Treatment becomes more complicated when supernumerary teeth are embedded. Surgical removal of embedded supernumerary teeth in children always carries the danger of damaging tooth buds of permanent teeth. 3D computerized tomography is very useful for locating supernumerary teeth and tooth buds of permanent teeth and evaluating their relationship in three dimensions (Gurler, Delilbasi, & Delilbasi, 2017).

Double teeth or fused teeth were found in primary dentition more frequently than in mixed dentition or permanent dentition. Double teeth are also the most common dental anomaly in primary dentition, both in the present study and in various other studies (Deolia et al., 2015; Kapdan et al., 2012; Kramer et al., 2008). The consequence of double primary teeth is usually congenital missing of related succedaneous teeth, which can lead to orthodontic issues in the future.

There were some limitations in this study includes non-inclusion of dental radiographs in all study cases which might have influenced the results. The correlation of dental anomalies and underlying disease was not achieved because of a too small group of children with underlying disease. Large-scale population-based studies would be required to further understanding of dental anomalies and underlying diseases as well as the application of this knowledge to general Thai population.

Conclusion

This study reveals the prevalence of dental anomaly in Thai pediatric patients from birth to age 12 (13.25%). The most common anomaly is congenital missing upper anterior permanent tooth followed by supernumerary tooth, embedded tooth, and enamel hypoplasia. Children age 6-12 had significantly more dental anomalies than children age 0-5 ($P=0.001$). There was no statistically significant difference in dental anomaly prevalence between boys and girls. Patients with cleft lip and palate showed a higher frequency of dental anomaly (congenital missing tooth being most frequent) than children with other systemic diseases or with a different physiological/psychological disorder.

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