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Paediatric oral pathology in Thailand: a 15-year retrospective review from a medical teaching hospital

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Objectives: To determine whether the spectrum of oral pathology in children seen at a medical institution differs from studies derived from dental facilities. **Methods:** Oral biopsy records from paediatric patients (<16 years of age) were retrieved from the pathology archives at Chulalongkorn University Hospital over a period of 15 years. Lesions were categorised as inflammatory/reactive, tumour/tumour-like or cystic. **Results:** Two-hundred and thirty biopsies were identified. Most lesions were inflammatory/reactive (62%), followed by tumour/tumour-like (35%) and cystic (3%). The largest proportion of lesions was found in the 12–16 years' age group. Mucocele was the most common lesion (38%), followed by hemangioma (8.3%), irritation fibroma (6%) and nevus (6%). The predominance of mucocele is similar to that in reports from other countries. The proportion of malignant tumours (5%) was higher than in other studies (<1–2%). In contrast, odontogenic cysts and odontogenic tumours were rare (3% and <1%, respectively), compared with published studies (7–35% and 2–21%, respectively). **Conclusions:** This study from a medical institution shows a somewhat different spectrum of paediatric oral pathology compared with that reported from dental institutions. While some of the lesions may not be treated by dentists, they still need to be aware of these lesions because affected patients can still present initially to a dentist.

Key words: *Oral pathology, paediatric dentistry, epidemiology, Thailand*

INTRODUCTION

Oral lesions in children show a spectrum which differs from that in adults, being related to growth and development, as well as specific lesions that predominate in the paediatric age group, such as vascular tumours and some types of lymphoma[1,2]. Previous studies regarding the prevalence of oral lesions in children have been based on retrospective review of pathology reports published from different regions of the world, including Argentina, Australia, Brazil, Chile, India, Nigeria, Turkey, Taiwan and Thailand, the UK and the USA[1–19]. In total, 2.8–16.2% of specimens come from patients in the paediatric age group, depending on the age cut-off used to define a paediatric patient[10,11]. These studies have been conducted in dental facilities, including hospital dental clinics, private dental clinics and university faculties, rather than medical facilities, such as general surgery and otolaryngology departments. As some patients seek attention at a medical facility instead of a dental facility, specimens submitted to medical institutions could show a different spectrum of disease, including entities under-represented in dental studies. To address this possibility, we surveyed oral surgical specimens examined in the Pathology Department of a medical teaching hospital in Thailand, with respect to diagnosis, biopsy site, patient age and gender. Results were compared with previously published literature, revealing both commonalities and differences. The present study, based on different source material, complements existing epidemiological studies on the spectrum of paediatric oral pathology.

MATERIALS AND METHODS

The records of all oral biopsies over a period of 15 years, spanning the period 1 January 2000 to 31 December 2014, were retrieved by computer database search from the archives of the Pathology Department

at King Chulalongkorn Memorial Hospital, Bangkok, Thailand. This hospital is a university-affiliated hospital that serves as a major referral centre for Bangkok and the central region of Thailand. King Chulalongkorn Memorial Hospital has no dental clinic. Specimens from dental patients are submitted separately to the Faculty of Dentistry and those specimens are not reflected in this study. Specimens in this study were derived from the Department of General Surgery and Otolaryngology. The study was approved by the Faculty of Medicine, Chulalongkorn University Institutional Review Board (Certificate of Approval #053/2017). The authors confirm that this study was conducted in full accordance with the World Medical Association Declaration of Helsinki. Patient data were anonymised and de-identified before analysis. The data collected for each lesion included patient age and gender, the anatomical location of the lesion and the pathology diagnosis. The upper age limit for a paediatric patient was designated as 16 years, and patients were divided into three age groups according to dentition period – (i) ≤6 years (primary dentition), (ii) 6–12 years (mixed dentition) and (iii) >12 years (permanent dentition) – following the design of two previous studies[1,19]. The diagnoses were grouped into three categories: (i) inflammatory/reactive lesions; (ii) tumour and tumour-like lesions; and (iii) cystic lesions[19]. The diagnoses of 'mucocele', 'ranula', 'mucous retention cyst' and 'mucous extravasation phenomenon' were all termed 'mucocele', and the diagnoses 'irritation fibroma', 'fibrous hyperplasia' and 'fibroma' were all termed 'irritation fibroma'. Malignancies were grouped as a separate subcategory within tumour/tumour-like lesions. The anatomical locations were grouped into: (i) lip; (ii) tongue; (iii) buccal mucosa; (iv) jaw; (v) palate; (vi) gingiva; and (vii) odontogenic. The jaw category was subdivided into maxillary and mandibular regions. For multiple biopsies from the same patient, the single most significant diagnosis was recorded for this study. Both biopsies and major resections were included in the study but all patients undergoing major surgery also had a previous biopsy and were therefore scored only once. There were no discrepancies between diagnosis at biopsy and at definitive resection. Biopsies considered as normal or inadequate were not included in the study. Data analysis was performed with SPSS statistical software (IBM, Armonk, NY, USA). The variables were compared using the chi-square test. All tests were performed at the two-sided significance level of 5%.

RESULTS

In total 3,887 oral biopsy specimens were obtained during the 15-year study period, 230 (6%) of which were from paediatric patients (≤16 years of age) (*Table 1*). Of these, ages ranged from 1 month to 16 years with a mean ±SD age of 12 ±4.6 years. There were 94 male subjects and 136 female subjects with a male:female ratio of 1:1.4. The frequency of lesions increased with patient age, from 13.9% for the age group of <6 years, to 35.2% for the age group of 6–12 years and to 50.9% for the age group of >12 years (ratio = 1:2.5:3.5). The difference in frequency between patients younger and older than 6 years of age was statistically significant ($P < 0.001$). The most common site for a lesion was the lip (48%), followed by the tongue (22%), buccal mucosa (8%), jaw (7%), palate (6%), gingiva (6%) and odontogenic (3%). Overall, there were 39 pathologic diagnoses (see *Table 2*). The most common lesions overall were in the reactive/inflammatory category (62%) followed by tumour/tumour-like (35%) and cystic (3%) categories.

Reactive/inflammatory lesions were mainly found in children in the age group >12 years (mean ±SD age: 12 ±4.5 years; male:female ratio = 1:1.3). Mucocele was the most common lesion ($n = 87$; 38%), followed by irritation fibroma ($n = 13$; 6%) and granulation tissue ($n = 9$; 3.9%). The tongue was a common site for these three lesions; however, mucocele most commonly involved the lip (78%) ($P = 0.01$), followed by the tongue (16%) and the buccal mucosa (6%) (*Table 3*).

The tumour/tumour-like category occurred mainly in children in the age group >12 years (mean ±SD: 12 ±4.6 years; male:female ratio = 1:1.7). The number of benign lesions (benign tumours and tumour-like lesions) was higher (37%) than the number of malignant lesions (4%) ($P < 0.001$). The most common

Table 1 Distribution of lesions according to gender and age

Lesion	Total	Sex		Age		
		M	F	<6 years	6–12 years	>12 years
Inflammatory/reactive	142 (62)	61	81	16	46	80
Tumour/tumour-like	81 (35)	30	51	14	31	36
Cystic	7 (3)	3	4	2	4	1
Total	230 (100)	94 (41)	136 (59)	32 (13.9)	81 (35.2)	117 (50.9)

Values are given as *n* or *n* (%).
F, female; M, male.

Table 2 Distribution of pathological diagnosis according to gender and age group

Lesion	Age group						Total		
	0–6 years		>6–12 years		>12–16 years				
	M	F	M	F	M	F	M	F	*n* (%)
Inflammatory/reactive									
Mucocele	2	6	5	23	25	26	31	56	87 (38)
Irritation fibroma	0	1	1	2	4	5	5	8	13 (6)
Granulation tissue	0	1	1	1	5	1	6	3	9 (3.9)
Inflammation	0	1	1	2	1	3	2	6	8 (3.5)
Epithelial hyperplasia	1	1	1	0	1	2	3	3	6 (2.8)
Pyogenic granuloma	0	0	3	1	0	2	3	3	6 (2.8)
Ulcer	0	0	0	1	3	0	3	1	4 (1.7)
Ranula	1	0	0	0	2	0	3	0	3 (1.3)
Osteomyelitis	1	1	0	0	0	0	1	1	2 (<1)
Erythroid hyperplasia	0	0	0	1	0	0	0	1	1 (<1)
Fungal granuloma	0	0	1	0	0	0	1	0	1 (<1)
Healed fracture	0	0	1	0	0	0	1	0	1 (<1)
Hyperplastic dental papilla	0	0	1	0	0	0	1	0	1 (<1)
Subtotal	5	11	15	31	41	39	61	81	142 (62)
Tumour/tumour-like									
Benign									
Hemangioma	2	2	1	9	2	3	5	14	19 (8.2)
Nevus	0	0	0	4	5	4	5	8	13 (6)
Lymphangioma	0	2	2	1	1	3	3	6	9 (3.9)
Fibrous dysplasia	0	0	2	0	2	3	4	3	7 (3)
Teratoma	2	2	0	0	0	0	2	2	4 (1.7)
Pleomorphic adenoma	0	0	0	0	1	2	1	2	3 (1.3)
Squamous papilloma	1	0	1	1	0	0	2	1	3 (1.3)
Arteriovenous malformation	0	0	0	0	0	2	0	2	2 (<1)
Ossifying fibroma	0	0	0	0	0	2	0	2	2 (<1)
Neurofibroma	0	0	1	0	0	1	1	1	2 (<1)
Brain heterotopia	0	1	0	0	0	0	0	1	1 (<1)
Central giant cell lesion	0	0	0	0	0	1	0	1	1 (<1)
Odontoma	0	0	0	0	1	0	1	0	1 (<1)
Schwannoma	0	0	1	0	0	0	1	0	1 (<1)
Nevus sebaceous	0	0	1	0	0	0	1	0	1 (<1)
Osteoma	0	0	0	0	0	1	0	1	1 (<1)
Malignant									
Non-Hodgkin lymphoma	0	1	3	0	0	1	3	2	5 (2.2)
Squamous cell carcinoma	0	0	1	0	0	1	1	1	2 (<1)
Mucoepidermoid carcinoma	0	0	0	1	0	0	0	1	1 (<1)
Malignant rhabdoid tumour	0	1	0	0	0	0	0	1	1 (<1)
MASC	0	0	0	1	0	0	0	1	1 (<1)
Epithelioid sarcoma	0	0	0	1	0	0	0	1	1 (<1)
Subtotal	5	9	13	18	12	24	30	51	81 (35)
Cystic									
Dentigerous cyst	0	0	1	3	0	0	1	3	4 (1.7)
Incisive canal	0	0	0	0	0	1	0	1	1 (<1)
Eruption cyst	1	0	0	0	0	0	1	0	1 (<1)
Radicular cyst	1	0	0	0	0	0	1	0	1 (<1)
Subtotal	2	0	1	3	0	1	3	4	7 (3)
Total (%)	12 (5.2)	20 (8.7)	29 (12.6)	52 (22.6)	53 (23)	64 (27.9)	94 (41)	136 (59)	230 (100)
M:F ratio	1:1.7		1:1.8		1:1.2		1:1.4		

Values are given as *n* or *n* (%).
F, female; M, male; MASC, mammary analogue secretory carcinoma.

lesion in this category was hemangioma ($n = 19$; 8%), followed by nevus ($n = 13$; 6%). Both lesions were found significantly more often on the lip compared with other sites ($P < 0.001$). The third most common lesion in this category was lymphangioma ($n = 9$; 4%), which was more commonly found on the tongue than on other sites, although this was not statistically significant ($P = 0.6$). The malignant group was most commonly found in the age group 6–12 years, but this was not statistically significant ($P = 0.5$). Non-Hodgkin lymphoma was the most common malignancy ($n = 5$; 2%), all of which were B-lymphocytic, specifically three cases of Burkitt lymphoma and two of diffuse large B-cell lymphoma. There was no predominant location for malignant lesions. Eleven cases (three of pleomorphic adenoma, four of teratoma, two of squamous cell carcinoma, one of mucoepidermoid carcinoma and one of mammary analogue secretory carcinoma; *Table 3*) were treated with major surgery.

Table 3 Distribution of pathological diagnosis according to anatomical location

Lesion	Anatomical location								Total
	Tongue	Buccal mucosa	Jaw		Lip	Palate	Odontogenic	Gingiva	
			Max	Man					
Inflammatory/reactive									
Mucocele	14	5	0	0	68	0	0	0	87
Irritation fibroma	7	3	0	0	2	1	0	0	13
Granulation tissue	4	1	0	0	0	2	0	2	9
Inflammation	4	0	0	1	1	0	0	2	8
Epithelial hyperplasia	2	0	0	0	2	0	0	2	6
Pyogenic granuloma	0	0	0	0	3	1	0	2	6
Ulcer	2	0	0	0	1	0	0	1	4
Ranula	3	0	0	0	0	0	0	0	3
Osteomyelitis	0	0	0	2	0	0	0	0	2
Erythroid hyperplasia	0	0	1	0	0	0	0	0	1
Fungal granuloma	0	0	0	0	0	1	0	0	1
Healed fracture	0	0	1	0	0	0	0	0	1
Hyperplastic dental papilla	0	0	0	0	0	0	1	0	1
Subtotal	36	9	5		77	5	1	9	142
Tumour/tumour-like									
Benign									
Hemangioma	3	1	0	0	15	0	0	0	19
Nevus	0	1	0	0	12	0	0	0	13
Lymphangioma	6	1	0	0	2	0	0	0	9
Fibrous dysplasia	0	0	5	2	0	0	0	0	7
Teratoma	0	2	0	0	0	2	0	0	4
Pleomorphic adenoma	0	0	0	0	0	3	0	0	3
Squamous papilloma	1	1	0	0	0	1	0	0	3
Arteriovenous malformation	0	0	0	0	2	0	0	0	2
Ossifying fibroma	0	0	2	0	0	0	0	0	2
Neurofibroma	0	0	0	0	1	1	0	0	2
Brain heterotopia	0	1	0	0	0	0	0	0	1
Central giant cell lesion	0	0	0	1	0	0	0	0	1
Odontoma	0	0	0	0	0	0	1	0	1
Schwannoma	1	0	0	0	0	0	0	0	1
Nevus sebaceous	0	0	0	0	1	0	0	0	1
Osteoma	1	0	0	0	0	0	0	0	1
Malignant									
Non-Hodgkin lymphoma	0	2	0	0	0	0	0	3	5
Squamous cell carcinoma	2	0	0	0	0	0	0	0	2
Mucoepidermoid carcinoma	0	0	0	0	0	1	0	0	1
Malignant rhabdoid tumour	0	0	0	0	1	0	0	0	1
MASC	0	1	0	0	0	0	0	0	1
Epithelioid sarcoma	0	0	0	0	0	0	0	1	1
Subtotal	14	10	10		34	8	1	4	81
Cystic									
Dentigerous cyst	0	0	0	0	0	0	4	0	4
Incisive canal	0	0	0	0	0	1	0	0	1
Eruption cyst	0	0	0	0	0	0	0	1	1
Radicular cyst	0	0	0	0	0	0	1	0	1
Subtotal	0	0	0		0	1	5	1	7
Total (%)	50 (22)	19 (8)	15 (7)		111 (48)	14 (6)	7 (3)	14 (6)	230 (100)

Values are given as *n* or *n* (%).
M, male; F, female; MASC, mammary analogue secretory carcinoma; Man, mandible; Max, maxilla.

In the category of cystic lesions, these were mainly found in patients in the 6- to 12-year age group (mean ±SD age: 8 ±3.9 years; male:female ratio = 1:1.3). Dentigerous cyst was the most common lesion (*n* = 4; 2%), followed by eruption cyst, radicular cyst and incisive canal cyst (<1% each).

DISCUSSION

In this study, we determined the prevalence of paediatric oral lesions occurring in a medical teaching hospital that serves as a major referral centre for central Thailand. The 6% prevalence of paediatric cases in our study was comparable with that of previous surveys of paediatric oral lesions carried out by dental facilities in different countries (see *Table 4*). These studies reported that ~10% of specimens submitted for pathology examination come from children[1–3,5,7,8,14,16]. A slight female predominance was observed in the present study, in contrast to no gender predilection or a slight male predominance in these other studies. However, differences in study design,

Table 4 Comparison of paediatric oral pathology from different countries

Authors (year)[ref.] (% of paediatric cases)	Period of study (years)	Age range (years)	Country	Most common cases		
				1st	2nd	3rd
Skinner *et al.* (1986)[16] *n* = 1,525 (12.8%)	14 (1969–1983)	0–19	USA	Mucocele	Irritation fibroma*	Inflammation
Das and Das (1993)[5] *n* = 2,370 (12.3%)	11 (1978–1988)	0–20	USA	Mucocele†	Periapical granuloma	Periapical cyst
Chen *et al.* (1998)[4] *n* = 534 (6%)	12 (1985–1996)	0–15	Taiwan	Mucocele†	Dentigerous cyst	Odontoma
Maia *et al.* (2000)[13] *n* = 1,018 (–)	43 (1956–1998)	0–12	Brazil	Follicular cyst	Irritation fibroma*	Mucocele
Lawoyin (2000)[10] *n* = 561 (16.2%)	11 (1986–1996)	0–16	Nigeria	Ameloblastoma	Periapical cyst	Burkitt lymphoma
Sousa *et al.* (2002)[17] *n* = 2,356 (–)	15 (1985–2000)	0–14	Brazil	Mucocele	Dentigerous cyst	Irritation fibroma*
Gultelkin *et al.* (2003)[6] *n* = 472 (5.5%)	8 (1990–1997)	0–15	Turkey	Peripheral giant cell granuloma	Hemangioma	Inflammation
Jones and Franklin (2006)[8] *n* = 4,406 (8.2%)	30 (1973–2002)	0–16	UK	Mucocele†	Periapical granuloma	Radicular cyst
Dhanuthai *et al.* (2007)[1] *n* = 1,251 (15.05%)	15 (1990–2004)	0–16	Thailand	Dentigerous cyst	Mucocele	Pyogenic ganuloma
Lima *et al.* (2008)[12] *n* = 625 (6.6%)	20 (1983–2002)	0–14	Brazil	Mucocele	Dentigerous cyst	Inflammation
Shah *et al.* (2009)[15] *n* = 5,457 (7%)	15 (1984–1999)	0–16	USA	Dentigerous cyst	Mucocele	Odontoma
Wang *et al.* (2009)[18] *n* = 797 (6.6%)	20 (1988–2007)	0–14	Taiwan	Mucocele†	Dentigerous cyst	Odontoma
Keszler *et al.* (2009)[9] *n* = 1,289 (6.8%)	26 (1960–1985)	0–15	Argentina	Mucocele	Radicular cyst	Gingivitis
Zuñiga *et al.* (2013)[19] *n* = 542 (20.6%)	15 (1995–2010)	0–16	Chile	Mucocele	Pyogenic granuloma	Irritation fibroma
Lei *et al.* (2014)[11] *n* = 1,023 (2.8%)	15 (1997–2011)	0–15	Taiwan	Mucocele	Odontoma	Dentigerous cyst
Ha *et al.* (2014)[7] *n* = 1,305 (13%)	58 (1945–2003)	0–16	Australia	Dentigerous cyst	Irritation fibroma*	Radicular cyst
Lapthanasupkul *et al.* (2015)[2] *n* = 1,389 (10.6%)	39 (1973–2011)	0–15	Thailand	Dentigerous cyst	Mucocele	Odontoma
Cavalcante *et al.* (2016)[3] *n* = 1,240 (13%)	12 (2001–2013)	0–16	Brazil	Mucocele	Dental follicle	Irritation fibroma‡
Patil *et al.* (2017)[14] *n* = 359 (12.1%)	10 (2005–2015)	0–17	India	Mucocele	Odontoma	Radicular cyst and periapical granuloma
Taweevisit *et al.* (this study) *n* = 230 (6%)	15 (2000–2014)	0–16	Thailand	Mucocele	Hemangioma	Nevus

*Referred to in the original publication as 'fibrous hyperplasia'.
†Referred to in the original publication as 'mucus extravasation phenomenon'.
‡Referred to in the original publication as 'fibroma'.

period of study and age-range stratification make direct comparisons difficult. The studies undertaken by Skinner *et al.*[5,16] and Das and Das designated patients up to 19 and 20 years of age, respectively, as 'paediatric', resulting in a prevalence of >10%. Interestingly, the studies by Cavalcante *et al.*[3,7], Dhanuthai *et al.*[1] and Ha *et al.*[7] limited the patient age to ≤16 years, but found a higher prevalence of 13–15%. Possible reasons for these differences could include a different patient population[3], bias as a result of the institute serving as a major referral centre or a longer period of study. The unusually high prevalence of 20.6% in a study on Chilean children[19] could be related to the proportion of paediatric patients in the study population, the use of data from a hospital to which paediatric patients preferentially go for treatment rather than dental practitioners and a national public health service that focusses on children[19]. The lower incidence of 6% in Chulalongkorn Hospital can be explained by the fact that our hospital is a university hospital rather than a dental institute and thus most of the patients are adults.

In the present study, the numbers of oral lesions increased with patient age in both the inflammatory/reactive and tumour/tumour-like categories. The prevalence was highest in the age group >12 years (51%), in contrast to previous studies that used the same age-range stratification[1,19] and in which the prevalence was highest in the age group 6–12 years (46–49%). One possible explanation is that invasive treatments may be delayed in paediatric patients and biopsied later in life when the patient has a greater understanding of the need for treatment and is therefore more compliant[7]. Also, some treatments,

such as cryotherapy, are preferentially used for benign lesions in younger children and may not yield tissue for pathologic examination[7]. It is also worth pointing out that the relative frequencies reported in this study and other studies do not necessarily reflect the actual prevalence or incidence of oral lesions in the paediatric population because diagnosis is sometimes based on clinical features alone without confirmation by biopsy[1,19]. However, studies based on biopsies only provide accurate information about the diagnoses.

Inflammatory/reactive lesions was the largest group in our study, with mucocele as the single most common lesion in this category (38%). This result is similar to that reported in many other studies, that mucocele was the most common[5,9,11,12,16–19] or the second most common[1,2,15] lesion observed. As these studies were from different regions worldwide, the incidence of mucocele does not appear to be affected by geographical regions or populations, or whether patients seek treatment from dental practitioners (reflecting previous studies) or medical practitioners (reflecting the present study). In these other studies, the frequency of mucocele ranged from 11% to 24%, which is lower than in our study. One reason is that these studies included a greater variety of diseases, resulting in a larger proportion of cystic lesions than seen in our hospital. In addition, some studies separated the pathological diagnoses of mucocele, ranula and mucous retention cyst[3,15,19], while in other studies, these entities were grouped under a single diagnosis of mucous extravasation phenomenon[4,18]. For the purposes of this paper, all of these lesions were referred to as 'mucocele'. It is possible that some of the variation in terminology might reflect that fact that biopsies taken in hospitals are read by anatomic or general pathologists, whereas biopsies from dental facilities are usually read by oral pathologists. However, on review of the publications from dental facilities, we found that the terminology is basically the same as that used by anatomic pathologists.

In the present study, tumour/tumour-like lesions and cystic lesions were the second (35%) and the third (3%) most common categories, respectively. A similar ranking has been noted in some previous studies[5,9–11,18,19] and a reverse ranking in some others[1,2,4,12,16,17]. Regardless of the reporting centre, the prevalence of cystic lesions in these studies ranges from 7% to 46%, which is higher than observed in our study. One possible explanation is that previous studies have been undertaken in dental facilities that are more likely to handle odontogenic cysts compared with a medical facility. For example, cystic lesions were the largest category in the study carried out by Dhanuthai *et al.*[1] because their institute is a major referral centre for orthodontic patients, in whom dentigerous cysts are often found incidentally during treatment planning. Another possible explanation is variability in the cases that are included in specific categories. For example, some studies include hyperplastic dental follicle in the tumour/tumour-like category[3], while other studies excluded this entity, considering it as normal.

In our study, for the category of tumour/tumour-like lesions, most (77%) were benign tumours of non-odontogenic origin, whereas odontogenic tumours were more common (15–21% of the total cases) in previous studies[1,2,10,11,18]. The most common tumour in our study was hemangioma (8%) followed by nevus (6%). Other studies showed the reverse order[12,17]. Overall, the frequency of hemangioma ranged from 0.5% to 12.7%[5,6], and the frequency of nevus ranged from <1% to 12%[5,17]. Malignant tumours were the smallest group (4%) in our study, all of which were non-odontogenic. A similar, low number of malignancies (<1–4%) was also observed in previous studies[1–9,11–13,15–19].

Non-Hodgkin lymphoma (in particular, Burkitt lymphoma) was the most common malignancy, which is in keeping with the predilection of this tumour in children and the relative rarity of epithelial cancers at this age. In areas of the world where this tumour is more common, such as Africa, studies showed a much higher prevalence of non-Hodgkin lymphoma compared with our study and those from the rest of the world[10]. We also observed one case each of mammary analogue secretory carcinoma, epithelioid sarcoma and malignant rhabdoid tumour. These tumours have not been reported in other studies from dental facilities. While these variations might result from geographical variation (as with Burkitt lymphoma), they could also reflect that patients with oral lesions not related to teeth prefer to undergo biopsy in a hospital environment as this may be followed by surgical resection.

The present study reflects paediatric oral pathology as seen exclusively by medical practitioners in a teaching hospital. There is considerable overlap in the diagnoses made by doctors and dentists, but the overall spectrum of disease in our study differs somewhat from that reported by dental institutions, with a lower frequency of odontogenic lesions balanced out by a higher proportion of tumour cases. Perhaps the closest comparison to our study would be similar studies from Thailand carried out by Faculties of Dentistry[1,2]. The study by Dhanuthai *et al.* originated from the same university as our study. Both studies included paediatric patients and used a similar age cut-off (15–16 years of age). Curiously, both studies had a significantly higher proportion of male patients (1.05:1 and 1.06:1) compared with our study (1:1.14), suggesting that parents are more likely to take male children

with oral lesions to a dentist. In the dentistry studies, odontogenic was the most common site for a lesion, compared with lip in our study. The three most common diagnoses (in order) were: dentigerous cyst and mucocele, and odontoma or pyogenic granuloma (depending on the study), compared with mucocele, hemangioma and irritation fibroma in our study. As might be expected, tooth-related lesions are more likely to be dealt with by dentists, with oral soft-tissue lesions handled by both dental and medical practitioners.

Differences between studies could be a reflection of the number of dentists at a particular institute, individual practice patterns for dentists and doctors, the type of facility in which specific lesions are managed and the health-care system in the particular country. In Thailand, the cost of the services is unlikely to influence the parent's choice of treatment by a dentist *versus* a doctor. Both private and government-operated institutions provide health care in Thailand, including dental and medical services. Private institutions can provide faster services but are considerably more expensive. Dentists' and doctors' offices outside the hospital setting are always private. For those who are working, health-care costs can be covered by the employer or by a health insurance company. There is also a health-care system in Thailand for the unemployed and for children, which makes all services, medical and dental, available for less than $1US. Care can be sought at either a private or a government-run facility, provided that the facility has agreed to participate in the plan. The present study is from a government institution that does not participate in this plan. However, because the cost of care at this institution is not high, there would be no socio-economic barriers as to which patients can be treated; hence, this is unlikely to influence the spectrum of pathology seen. In support of this impression, the study from a Thai faculty of dentistry from a participating institution[1] had similar results to the one involving a non-participating institution[2].

In Thailand, parents would generally take their children to a dentist for a tooth problem and to a doctor for an oral soft-tissue lesion. Odontogenic cysts would tend be identified on dental X-rays and then handled by the dentist, but some odontogenic lesions might be referred by a dentist to an oral surgeon for treatment. For parents choosing to see a doctor, parents can select to see a general surgeon or an otolaryngologist without first having to see a family doctor. A family doctor would generally refer to a general surgeon or an otolaryngologist for treatment of an oral lesion, although odontogenic cysts would probably be referred to a dentist. These patterns of practice would help to explain why odontogenic cysts and odontoma are among the most common lesions documented in the studies by faculties of dentistry are, whereas in our study, based on specimens from doctors, the most common lesions are soft tissue in nature and not odontogenic. While some of the lesions observed in our study may not be treated by dentists, dental practitioners should nevertheless be aware of these lesions as affected patients can still present to the dentist first.

Conflicts of interest

The authors confirm that there are no known conflicts of interest associated with this publication. No funding was received for this study.

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