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Original Article

A 2-year retrospective study of pediatric dental emergency visits at a hospital emergency center in Taiwan

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ABSTRACT

Background: There is a paucity of information regarding pediatric dental emergencies in Taiwan. This study investigates the prevalence and characteristics of the pediatric dental emergency services provided at a medical center.

Methods: This study included a retrospective chart review of patients under 18 years of age with dental complaints who visited the Emergency Department (ED) of Linkou Medical Center of Chang Gung Memorial Hospital from January 2012 to December 2013. Information regarding age, gender, time/day/month of presentation, diagnosis, treatment, and follow-up was collected and analyzed. Statistical analysis included descriptive statistics and Pearson's Chi-square test with the significance level set as $p < 0.05$.

Results: This study revealed that dental emergencies in the medical center ED were predominantly related to orodental trauma (47.1%) and pulpal pain (29.9%). Most patients were male ($p < 0.001$) and <5 years of age ($p < 0.001$). The most frequent orodental trauma was luxation, both in primary and permanent dentition. The major management for dental emergencies was prescribing medication for pulp-related problems and orodental trauma. The follow-up rate of orodental trauma was the highest ($p < 0.001$).

Conclusions: For children, trauma and toothache constituted the most common reasons for dental emergency visits at a hospital emergency center in Taiwan. While dental emergencies are sometimes unforeseeable or unavoidable, developing community awareness about proper at-home care as well as regular dental preventive measures can potentially reduce the number of emergency visits.

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At a glance commentary

Scientific background on the subject

There is a paucity of information regarding pediatric dental emergencies for children in Taiwan. This retrospective chart review study investigates the prevalence and characteristics of pediatric dental emergency services provided at a medical center over a 2-year period.

What this study adds to the field

This study reveals that the majority of pediatric dental emergencies are either dental trauma or pulp-related problems. This information can be used to help improve future Emergency Department services.

The Emergency Department (ED) visit is generally preceded by an urgent condition due to injury, accident, disaster, or disease that requires immediate medical management [1]. It is also common for children to visit the ED for dental problems. The American Dental Association (ADA) and the American Association of Oral and Maxillofacial Surgeons (AAOMS) define dental emergencies as jaw and alveolar bone fractures, avulsed or displaced teeth, fractured teeth with pulp exposures, acute alveolar abscess, upper airway impairment, oral mucosal lacerations, acute dental pain and infection, and uncontrolled bleeding [2]. Previous studies suggested that the main reasons for children's ED visits were toothaches associated with dental caries, dental trauma, swelling of soft tissue, and tooth eruption problems [3–6]. In a 9-year study of ED visits conducted at a children's hospital and medical center in the US, trauma accounted for 60% of the emergencies, while dental infections as the reason for the visit increased from 30 to 44% in a 4-year period [7]. According to a report in 2006, the prevalence of ED visits for pediatric dental care has been increasing in the last two decades [5].

The Linkou Medical Center of Chang Gung Memorial Hospital (LMCCGMH) is the largest hospital in Taiwan and has an ED that functions as one of the emergency medical centers and serves a wide geographic area in Northern Taiwan. About 100,000 patients visit the ED of LMC at CGMH each year. Among these visitors, more than 1000 have dental complaints.

There is a paucity of information regarding the prevalence and dental emergency types of ED visits in a medical center setting in Taiwan, and the characteristics of pediatric dental emergency of LMCCGMH have never been reported. Therefore, the objective of this retrospective study was to investigate the prevalence and characteristics of the pediatric dental emergency visits of the CGMH ED over a 2-year period.

Subjects and methods

A retrospective chart data review of patients under 18 years of age with dental complaints who visited the CGMH ED from January 2012 to December 2013 was conducted after obtaining Institutional Research Ethics approval from CGMH (IRB

number: 103-1950B). Electronic medical records were reviewed by a single pediatric dentist (CPJ). Statistics were then derived from the data set. Standard quantitative analyses were conducted using Microsoft Excel formulas (2013, Microsoft Corporation). Statistical analysis was carried out descriptive statistics and Pearson's Chi-square test with the significance level set as $p < 0.05$ using Statistical Package for Social Science software (version 19.0; SPSS Inc., Chicago, Illinois, USA).

The following information was collected:

- The time, day, and month of a patient's ED visit
- Patient demographics: age, gender
- Diagnosis (pulp-related problems, orodental trauma, eruption-related problems, orthodontics or space maintainers-related problems, bleeding, ulceration, etc.)
- Diagnosis of pulp-related problems: primary or permanent tooth and area of tooth (upper anterior, upper posterior, lower anterior, and lower posterior) were recorded. In addition, the presence of swelling or abscess was noted
- Diagnosis of orodental trauma: defined as those involving injuries to the teeth, soft tissues and jaws. Information about the type of tooth (primary or permanent) and its classifications of trauma were recorded. The classification includes injuries to the teeth, supporting structures, gingival, and oral mucosa [8]
- Treatment: consultation and oral hygiene instruction only, dental treatment only (including local anesthesia injection), medication only, dental treatment with medication and oral hygiene instruction.
- Utility rate of dental X-rays in dental emergency room (yes or no)
- Whether a follow-up visit in the dental Out-patient Department within 2 weeks was needed.

Results

From January 2012 to December 2013, a total of 397 children with dental problems had visited LMCCGMH for dental emergencies, which represents 0.77% (397/51766) of all pediatric patients in ED during the 2-year period. Six cases were excluded due to incomplete chart data. Data were available for a total of 391 participants.

The number of visits of patients with dental problems peaked in December and January (23.8%) [Fig. 1]. Two hundred and thirty-three patients (59.6%) visited on weekends. The peak time of dental emergency visits was between 21:00 and 24:00 (26.1%) [Fig. 2].

Patient demographics

Of 391 patients, there were 235 males (60.1%) and 156 females (39.9%) ($p < 0.001$). Ages ranged from 2 days to 17 years old, with a mean of 6.37 years. Most children seeking emergency dental services (176/391, 45.0%) were 4 years of age or younger ($p < 0.001$). The age distribution for children visiting dental ED is presented in Fig. 3. The peak age of pulp-related problems was 4 years old, whereas the peak age of trauma was 2 years old.

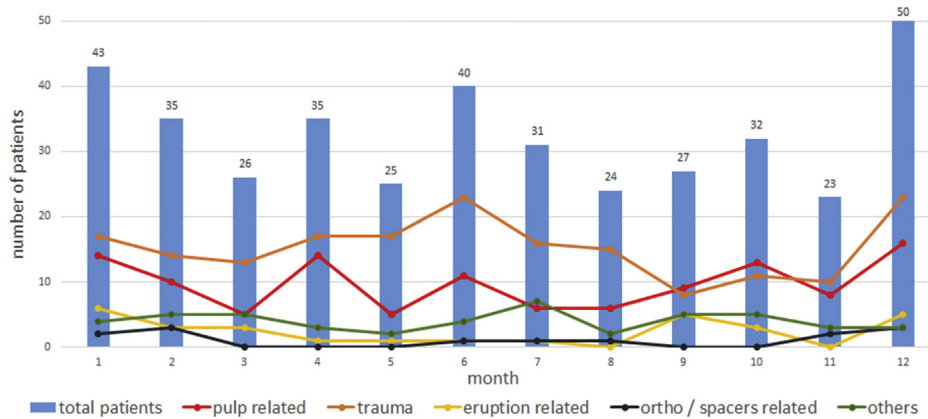


Fig. 1 – Distribution of number of patients who visited the Emergency Department with dental problems in relation to month.

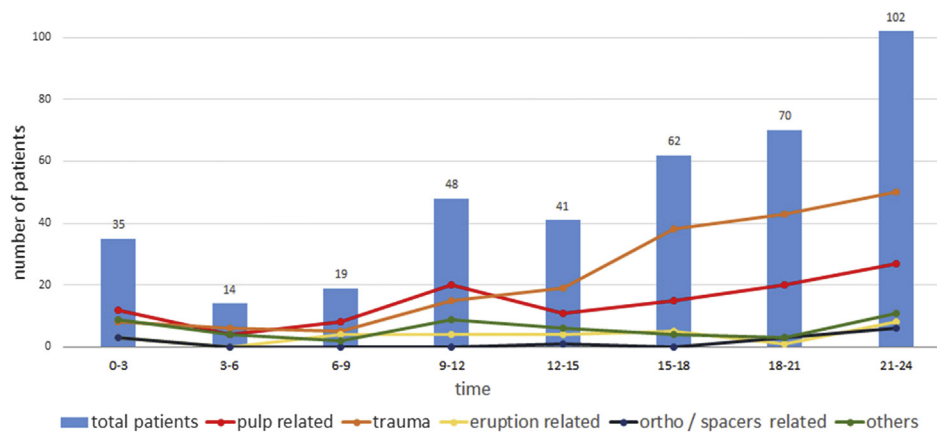


Fig. 2 – Distribution of number of patients who visited the Emergency Department with dental problems in relation to time.

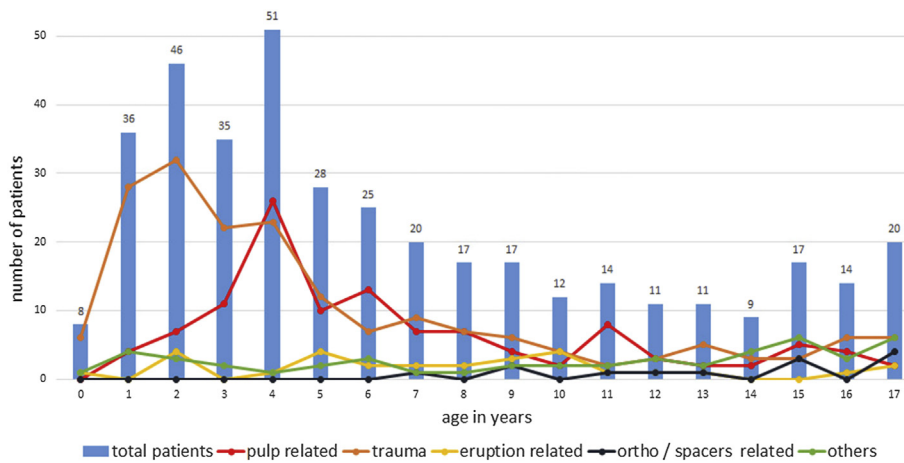


Fig. 3 – Distribution of number of patients who visited the Emergency Department with dental problems in relation to age.

Reasons for emergency care and diagnosis

Reasons for seeking emergency dental treatment included pulp-related problems (29.9%), orodental trauma (47.1%), eruption-related problems (7.4%), complications related to orthodontics or space maintainers (3.3%), and other reasons (12.3%) including bleeding and ulceration. Table 1 shows

emergency visits sorted by main problems according to the clinical examination and diagnosis.

Pulp-related problems

A total of 117 (29.9%) patients visiting the ED presented pulp-related problems. There were 74 males (63.2%) and 43 females ($p = 0.004$). Forty-nine (41.9%) children with pulp-

Table 1 – Reasons of seeking dental emergency services (n = 391).

Reasons	Number of patients (%)
Pulp-related problems, n (%)	117 (29.9)
Orodoental trauma, n (%)	184 (47.1)
Eruption-related problems, n (%)	29 (7.4)
Orthodontics/spacers-related problems, n (%)	13 (3.3)
Others, n (%)	48 (12.3)

related problems were between age 4 and 6 ($p < 0.001$). All these patients complained of dental pain and 55 patients (47.0%) presented facial cellulitis, localized gingival swelling, or dental abscesses. Pulp-related problems occurred more frequently in primary teeth (78.6%) than in permanent teeth (21.4%). In both dentitions, the mandibular posterior teeth were the most frequently involved (44.6% in primary teeth, 52% in permanent teeth), whereas the lower anterior area was least afflicted (2.2% and 0%, respectively) [Table 2].

Orodoental trauma

A total of 184 children presented traumatic injuries and accounted for 47.1% of the dental emergency visits. Trauma occurred more frequently in children below 5 years of age (111/184, 60.3%). The number of patients with traumatic injury was significantly different between ages ($p < 0.001$) and more likely to occur in males (119/184, 64.7%) than in females ($p < 0.001$). A total of 328 teeth were affected by trauma, excluding 25 children who only had soft tissue injuries and two children who had no visible injury according to the classification system adopted by the World Health Organization in its Application of International Classification of Diseases to Dentistry and Stomatology [8]. Most children had one or two teeth affected (120/157, 76.4%), with an average of 2.09 teeth per child, and 23.6% of the patients had more than three teeth injured in a dental emergency visit. Table 3 shows the distribution of patients presenting with various types of oroadoental trauma. Many of the patients sustained more than one type of injury. The majority of permanent teeth trauma was injuries to the periodontal tissue (93/169, 55.0%), including concussion, subluxation, extrusion luxation, lateral luxation, intrusion luxation, and avulsion, followed by tooth fracture (44/169, 26.0%). Among the traumatized primary teeth, 66.5% (181/272) were luxated and 10.3% (28/272) were fractured [Table 3].

Eruption-related problems

Eruption-related problems commonly occur in children with mixed dentition. A total of 29 children (7.4%) visited the ED due to eruption-related problems. Fourteen patients complained of pain due to exfoliating primary teeth. Fourteen patients had

Table 2 – Teeth of pulpal related problems presented in dental emergencies (n = 117).

Variable	Primary dentition (n = 92)	Permanent dentition (n = 25)
Upper anterior, n (%)	27 (29.3)	4 (16.0)
Upper posterior, n (%)	22 (23.9)	8 (32.0)
Lower anterior, n (%)	2 (2.2)	0 (0.0)
Lower posterior, n (%)	41 (44.6)	13 (52.0)

Table 3 – Classification of traumatic dental injuries by incidence (n = 441).

Variable	Primary dentition (n = 272)	Permanent dentition (n = 169)
Injuries to the hard dental tissues and the pulp, n (%)	28 (100.0)	44 (100.0)
Enamel infraction	1 (3.6)	5 (11.4)
Enamel fracture	3 (10.7)	9 (20.4)
Enamel-dentin fracture	4 (14.3)	15 (34.1)
Complicated crown fracture	13 (46.4)	14 (31.8)
Uncomplicated crown-root fracture	2 (7.1)	1 (2.3)
Complicated crown-root fracture	1 (3.6)	0 (0.0)
Root fracture	4 (14.3)	0 (0.0)
Injuries to the periodontal tissues, n (%)	181 (100.0)	93 (100.0)
Concussion	13 (7.2)	15 (16.1)
Subluxation	82 (45.3)	36 (38.7)
Extrusion luxation	4 (2.2)	4 (4.3)
Lateral luxation	36 (19.9)	13 (14.0)
Intrusion luxation	19 (10.5)	4 (4.3)
Avulsion	27 (14.9)	21 (22.6)
Injuries to the supporting bone, n (%)	3 (100.0)	8 (100.0)
Comminution of the maxillary alveolar socket	0 (0.0)	1 (12.5)
Comminution of the mandibular alveolar socket	0 (0.0)	0 (0.0)
Fracture of the maxillary alveolar socket wall	0 (0.0)	0 (0.0)
Fracture of the mandibular alveolar socket wall	0 (0.0)	1 (12.5)
Fracture of the maxillary alveolar process	2 (66.7)	2 (25.0)
Fracture of the mandibular alveolar process	1 (33.3)	1 (12.5)
Fracture of the maxilla	0 (0.0)	0 (0.0)
Fracture of the mandible	0 (0.0)	3 (37.5)
Injuries to gingiva or oral mucosa, n (%)	60 (100.0)	24 (100.0)
Laceration of gingiva or oral mucosa	45 (75.0)	17 (70.8)
Contusion of gingiva or oral mucosa	5 (8.3)	1 (4.2)
Abrasion of gingiva or oral mucosa	10 (16.7)	6 (25.0)

pain associated with an erupting tooth, and in addition, four of them suffered from facial cellulitis due to pericoronitis. A neonatal tooth eruption was the cause for dental emergency visit in one child.

Orthodontics or space maintainers-related problems

A total of 13 children (3.3%) visited the ED because of discomfort related to orthodontic appliances (such as a broken wire, broken appliance, dislodged bracket, or mucosa irritation). One patient presented with cellulites caused by mini screws. Two patients came to ED due to a broken space maintainer.

Others

A total of 48 children (12.3%) suffered from soft tissue pathoses. Bleeding and gingivitis were the most common

Table 4 – Management of the emergencies based on reasons of visits.

Variable	Pulp-related problems (n = 117)	Orodonal trauma (n = 184)	Eruption-related problems (n = 29)	Orthodontics/spacers-related problems (n = 13)	Others (n = 48)
Consultation and oral hygiene instruction only, n (%)	2 (1.7)	16 (8.7)	6 (20.7)	1 (7.7)	6 (12.5)
Dental treatment only, n (%)	0 (0)	6 (3.3)	8 (27.6)	7 (53.8)	22 (45.8)
Medication only, n (%)	94 (80.3)	90 (48.9)	8 (27.6)	1 (7.7)	13 (27.1)
Dental treatment with medication and oral hygiene instruction, n (%)	21 (18)	72 (39.1)	7 (24.1)	4 (30.8)	7 (14.6)
Utilization of dental X-rays, n (%)	50 (42.7)	102 (55.4)	12 (41.4)	0 (0)	12 (25.0)

problems. Twenty-two patients had bleeding gums, and eight patients had gingivitis, which was more commonly seen in teenagers. Six children complained of pain due to ulceration. Four patients came to dental emergency visit due to cystic lesions with active symptoms and signs. One patient had labial frenum swelling with *Enterovirus* infection and the rest of the seven patients sought emergency care for gum pain caused by unknown reasons.

Management

The major management for dental emergencies was prescribing medication (mainly analgesics and antibiotics) (52.7%) for pain and infection control, followed by dental treatment with medication (28.4%), dental treatment (11.0%), and consultation and oral hygiene instruction (7.9%). Of 176 cases (45% of the total emergency visits) that used radiography in the dental emergency room, most were cases of patients who had had orodontal trauma. Management based on reasons of visits is shown in Table 4.

After a dental emergency visit, the majority of patients were referred to local dental clinics (57.3%). However, 42.7% of the patients had a follow-up appointment in the CGMH pediatric Out-patient Department within 2 weeks. The re-visit rate of the orodontal trauma group (50.5%) was the highest among the groups, whereas the re-visit rate of problems related to other issues was the lowest [Table 5]. Re-visit rates were significantly different between groups ($p < 0.001$).

Discussion

This retrospective study assessed the demographic and clinical characteristics of children attending an emergency dental service at a Northern Taiwan medical center. According to a search of the medical literature, this study provides the first pediatric dental emergency information ever reported. Several parameters, including the peak month, day, hour, and treatment, were assessed. This study sheds light on the emergency dental situation in Taiwan.

These results revealed that orodontal trauma was the most frequent cause of emergency care (47.1%). A previous dental emergency study conducted in Taiwan [9] found that 31% of dental emergencies in a veteran's hospital were due to trauma; however, the study included both children and adults. Most children with dental injuries at our dental emergency clinic had more than one tooth traumatized, with an average number of 2.09 teeth. Similar findings have been reported in another study of dental trauma at a major pediatric clinic [3].

In this study, luxation injuries appeared more frequently in both primary and permanent dentition. According to the literature, luxation injuries were the most frequently occurred type other than avulsion in both the primary and permanent dentition [10]. In contrast, a study assessing the dental injury types in a university-based pediatric dentistry postgraduate outpatient clinic reported that luxation injuries were seen more often in primary dentition whereas tooth fractures were more common than luxation in permanent dentition [3]. Primary incisors tended to be luxated more than permanent teeth [10–13]. Some authors have attributed this difference to the spongy nature of the supporting structures surrounding primary dentition in young children and to the lower root/crown ratio, compared to permanent teeth, thereby favoring luxation injuries over fractures [8].

Previous reports have indicated that boys experienced trauma injuries to the teeth more frequently than girls [8]. A male to female ratio as high as 2.71:1 has been reported [3,14]. This study yielded similar results (2.83:1). It is commonly believed that boys between 7 and 12 years of age tend to be more active and more involved in physical contact sports than girls are [3,8].

Previous studies conducted in the USA have reported that 30–40% of dental emergency cases in pediatric hospitals were due to carious teeth [3,5,15,16]. Many of these children are from low socioeconomic group and do not have health insurance [3,5]. Abscesses and cellulites (26.7%) and pain caused by dental caries (30.2%) were the main reasons for emergency visits in the USA studies [3,17]. Some studies conducted in

Table 5 – Follow-up visit appointment within 2 weeks based on different reasons.

Variable	Pulp-related problems (n = 117)	Orodonal trauma (n = 184)	Eruption-related problems (n = 29)	Orthodontics/spacers-related problems (n = 13)	Others (n = 48)	p
Re-visit, n (%)	53 (45.3)	93 (50.5)	6 (20.7)	6 (46.2)	9 (18.8)	<0.001

other countries also yielded similar reasons [1,3,4]. In the USA and Canada, the ED service is an important point of entry into the healthcare system for poor and uninsured patients and persons with difficulty accessing routine preventative services [6,18]. However, Taiwan is unlike the USA and Canada in that basic dental treatments such as extraction, amalgam and composite resin restoration, endodontic treatments, and periodontal treatments are covered by the Government through the National Health Insurance system. Dental emergency services involving the dental treatments mentioned above are also covered. This present study suggests that dental caries are still a key cause of dental emergencies.

Dental caries are commonly seen in children in Taiwan. A previous national dental survey reported a very high level of caries problem, in which the deft index for children at age 3, 4, 5, and 6 was 2.58, 4.41, 6.94, and 7.31, respectively [19]. In the present study, caries-associated dental pain accounted for 29.9% of pediatric dental emergency visits. The peak age for this group of patients was 4 years of age. Young children needing emergency treatment may create a difficult treatment situation for both the patient and dentist. Emergency treatment is usually provided by the on-duty dental resident, and optimal behavior management is often compromised when operative or surgical treatment becomes necessary in this age group during after hours. Table 4 shows that caries-associated pain or problems were predominantly treated with medication prescription, reflecting a behavior management difficulty. Even if the pain or infection was treated at the ED, the underlying dental problem was often not resolved.

Emergency visits related to soft tissue pathoses in this study ranged from conditions commonly seen in children, such as gingivitis, gum bleeding, and pain due to aphthous ulcers, to less frequent lesions, such as cystic lesions. Gingivitis is a very common childhood oral condition and generally not associated with any discomfort, but it is frequently related to improper oral hygiene [20]. Bleeding is often seen, especially in children with eruption gingivitis, and the associated bleeding is usually the primary reason for seeking emergent dental care [3].

Eruption-related problems, such as permanent tooth eruption and primary tooth over retained, as well as pericoronitis around erupting permanent teeth, were commonly seen in mixed dentition children [3]. Of the 29 patients, 14 patients complained of pain due to exfoliating primary teeth. Four patients showed cellulitis due to pericoronitis.

The proportion of children in this study presenting complaints other than caries/pulpitis, cellulitis, and orodental trauma was relatively high. Some of these patients were not in pain or had symptoms that were purely physiologic, such as primary tooth exfoliation or permanent tooth eruption. Almost one-fifth (81/391, 20.7%) of all ED visitors in this current study did not need immediate attention according to the ADA and AAOMS definitions [2]. This included 25 patients seeking ED assistance for eruption-related problems, 12 for orthodontic appliances and space maintainers, and 44 patients for gum problems. The utilization of dental emergency appointments for nonemergency situations may reflect “abuse” of the healthcare system by using such emergency services as primary care and in lieu of regular dental care. This study indicates that the hospital ED needs to develop a

screening method for determining true dental emergencies, triaging emergency care, and prioritizing patients who need urgent dental care.

Conclusions

For children, trauma and toothache constituted the most common reasons for dental emergency visits at a hospital emergency center in Taiwan. While some dental emergencies are unforeseeable or unavoidable, increasing knowledge and awareness about proper at-home care as well as regular checkups may be a social initiative that can help reduce the high frequency of ED visits that involved preventable conditions, such as early childhood caries.

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Conflicts of interest

There are no conflicts of interest.

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