

## Dental injuries among children and adolescents aged 1–15 years attending to public hospital in Temuco, Chile

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**Abstract** – A cross-sectional study was carried out in children and adolescents of both sexes, aged 1–15 years that sought dental emergency attention to the Regional Hospital between 2004 and 2007 in Temuco, Chile. The purpose of this study was to identify the aetiology, types of traumatic dental injuries in primary and permanent dentitions, sex and age distributions, accident location; and time elapsed before emergency treatment in children and adolescents. The sample consisted of 359 patients with 145 primary teeth and 525 permanent teeth affected by dental trauma. The results showed a 2:1 male:female ratio distribution (242/117) with a mean age of 8.4 years. The 7- to 12-year-old group had the highest frequency of dental injuries (66.6%). Unspecific accidental falls were the main cause of injury to primary and permanent dentition (51.8%), followed by striking teeth against objects (15.6%) and bike accidents (13.9%). In primary dentition the most common diagnosis were subluxation (38.6%) and avulsion (16.6%), whereas in permanent dentition was uncomplicated crown fracture (32.9%). A high proportion of the patients received their first emergency attention 24 h after the accident (32.6%). This study revealed a high frequency (37.9%) in 1–15 aged population that sought emergency attention by dental trauma in the period of time study. A large proportion of children with dental trauma received delayed first emergency care, even 24 h after the accident. Considering the high frequency of traumatic dental injuries in 1–15 aged population and the high percentage of delayed emergency attention is necessary to develop effective educational campaigns in regard to causes, prevention and emergency management of traumatic dental injuries, especially in deprived areas. In conclusion, traumatic dental injury may be considered as a serious dental public health problem especially in children of deprived areas.

Due to an increase in recreational and sports activities in school-aged children and adolescents, the frequency of dental trauma is increasing worldwide. Several studies have demonstrated a substantial increase in this pathology over the past few decades (1–3). Other studies worldwide reveal that dental trauma represents one of the most common reasons for seeking emergency treatment (4). Glendor stated that dental trauma is a severe public dental health problem and that there will likely be an increase in its prevalence in the future (5). In research by Borssen and Holm, data showed that 35% of children had sustained an injury to the primary or permanent dentition on one or more occasions (3). The literature shows that most compromised teeth are both primary and permanent upper maxillary incisors (5–9). These oral injuries cause aesthetic, psychological, social, functional and therapeutic problems and can cause irreparable dental loss, not only at the time of accident, but also during the post treatment period (10). Due to its high prevalence traumatic dental injuries constitute a true and

serious dental public health problem (5, 8–11). Therefore, dentoalveolar injuries should be of interest to clinicians and emergency health care services administrators concerned about the high-quality operation of emergency rooms (7).

The reported prevalence of traumatic dental injuries (TDI) varies widely in the literature due to various factors such as type of study, patient selection method, trauma classification, diagnosis criteria applied, injury registration procedure, research methodology, age group, geographical characteristics, socio-economic status and cultural and behavioural factors (9, 12, 13). In several studies, the risk factors for dental trauma such as increased incisal overjet, inadequate lip coverage and socioeconomic status have been established, as well as the association between overweight and traumatic dental injuries (4, 14).

In different reports, the prevalence of traumatic injuries to primary and permanent dentition varies widely from 11–35% and 2.6%–50%, respectively.

Overall, statistics from most countries show that one third of all preschool children have suffered dental trauma to the primary dentition and one fourth of all school children have suffered dental trauma to the permanent dentition before leaving school (1, 5, 15, 16).

Regards age as a risk factor for dental trauma, several studies have demonstrated that most dental injuries occur in children and adolescents. In most surveys, males experience significantly more dental trauma than females (1–3, 5, 7, 9, 11).

Falls during leisure activities, both at home and on the playground, collisions, bicycle accidents and different sports activities have been reported as the primary causes of dental injury in young children and teenagers worldwide (9, 15, 17–21). Luxation injuries with displacement are the most common diagnosis of the primary dentition, while injuries to the coronal hard tissues and the pulp are the most frequent diagnoses of the permanent dentition (1, 2, 9, 15).

This study presents the results of a three year survey of the occurrence and characteristics of dental injuries (e.g. causes, type of injury, affected dentition, location of accident, time elapsed to first emergency attention, gender, age and socio-economic distribution of the patients) in 1- to 15-year-old patients admitted to the Dental Emergency Room and followed-up at Paediatric Dental Clinic of Regional Clinical Hospital at Temuco, Chile. Additionally, relevant aspects of the first emergency management of avulsed permanent teeth were assessed (e.g. time elapsed until tooth replant, storage and transport media).

## Materials and methods

### Participants and registration of dental trauma

A dental trauma cross-sectional study was carried out based on the clinical data of 359 patients, ranging from 1 to 15 years of age, of both sexes, that were examined and treated for different dental injuries. These patients were referred to the Paediatric Dental Service of the Regional Clinical Hospital in Temuco, Chile over a 40-month period from March 2004 to June 2007. The patients treated at this dental centre were referred from different cities, towns and villages of the Araucania Region (869 535 habitants), which is located 700 km south of the capital city, Santiago. According to the Chilean National Institute of Statistics, Temuco is the capital city of the Araucania Region and the most important commerce and industrial centre of the province, with a resident population of over 280 000 inhabitants and a large floating population from surrounding areas. Also, the Araucania Region is one of the poorest areas of the country with a significant percentage of the total population (26%) being native rural.

Children and adolescents involved in a traumatic event usually seek emergency treatment at the Critical Care Unit of Regional Hospital in Temuco. When oral soft tissues and/or hard tissues are compromised, the patients are referred to the Dental Emergency Room for evaluation and emergency treatment by the resident dentist, paediatric dentist and/or maxillofacial surgeon. After the first

treatment, the patients are sent to the Paediatric Dental Service for subsequent management (e.g., restorative treatment, splint removal, assessment of healing and follow-up). Patients with complex dental injuries are assessed and treated with an interdisciplinary staff composed of general dentists, endodontic and orthodontic specialists, oral and maxillofacial surgeons, paediatric dentists and oral radiologists. The majority of children are referred to the hospital from schools, primary health centres, the Paediatric Surgery Service and other hospitals.

Chilean students with dentoalveolar injuries may request emergency attention at public hospitals, which provide free dental care. Children and adolescents from public schools and universities are protected by Government Health Insurance at public hospitals of the National Health Service System (NHSS).

For all patients, data were registered in a record form adapted from Andreasen & Andreasen (22) Information regarding gender, age, location of the accident, aetiology, diagnosis, type and number of affected teeth, tooth colour, extension of fracture, aspect of pulp exposure, presence of crown fragment, mobility and tooth displacement, percussion test, types of soft tissues injuries, storage and transport medium, and extra-alveolar time in cases of avulsion were recorded. Dental injuries of primary and permanent dentition were analysed separately. Patients with maxillofacial and jaw fractures were excluded from this study.

Data were processed with STATA 9.2 statistical software program (Stata Corp. LP, College Station, TX, USA). Statistical analysis was carried out by a Fisher test to determine statistical significance. The statistical significance level was set at  $P < 0.05$ . The descriptive statistical analysis included frequency, distribution, as well as the different associations between age, gender, aetiology, diagnosis, accident location and time of the emergency treatment.

## Results

Between 2004 and 2007, 3985 patients (children, adolescents and adults) sought treatment for dental emergencies at Dental Emergency Room of Regional Clinical Hospital in Temuco. Of them, 1719 (43%) corresponded to children and adolescents aged 1–15 years. The reasons for seeking emergency dental treatment included pain associated with caries, odontogenic infections, maxillofacial fractures, dental trauma, oral soft tissue injuries and different soft tissues pathoses such as herpetic gingivostomatitis, aphthous ulcers, and candidiasis. Of all dental emergencies of children aged 1–15 years, 652 (37.9%) were due to dental trauma (Table 1). Of them, 254 patients were referred to Paediatric Dental Service for subsequent clinical management and follow-up, while 53 patients were referred directly from school and 38 patients directly from the Primary Health Centre. Twelve patients were referred to the Paediatric Dental Service from the Paediatric Medical Service because they were in the hospital due to otorrhagia, severe epistaxis with nasal fracture or severe soft tissue injuries of the facial skin. Two patients were referred from the Intensive Paediatric Care Service, because they presented with compromised

Table 1. Distribution of dental emergencies in 1- to 15-year-old children and adolescents at Dental Emergency Room of Regional Clinical Hospital in Temuco, Chile (2004–2007)

Reasons for emergency treatment	Description	<i>n</i>	%
Dental pain/discomfort associated with caries	Irreversible pulpitis, fracture and or lost of restorations	294	17.1
Dental pain associated with odontogenic infections	Pericoronitis, acute dental abscess, dental fistulae, odontogenic facial cellulitis	262	15.2
maxillofacial fractures	Mandibular fracture, cigomato-malar fractures, etc.	15	0.9
Dental trauma in patients <6 years (primary dentition)	Crown fractures, root fractures, crown-root fractures, subluxation, lateral and extrusive luxation, intrusion, avulsion	219	12.7
Dental trauma in patients ranged 7–15 years (permanent dentition)	Crown fractures, root fractures, crown-root fractures, subluxation, lateral and extrusive luxation, intrusion, avulsion	433	25.2
Traumatic oral soft-tissue injuries	Abrasions, contusions, bruises, haematomas, lacerations of oral mucosa and/or peri-oral skin	238	13.8
Other conditions	Non-traumatic soft-tissue lesions (herpetic gingivostomatitis, aphthous ulcers, candidiasis, etc.), neonatal teeth, ectopic eruption of permanent teeth, disturbances in exfoliating primary teeth, mucocele, discoloration or hypoplasia, allergy, earache, mumps	258	15.0

Table 2. Distribution of children with dental injuries by age and gender

Age group (years)	Male, <i>n</i> (%)	Female, <i>n</i> (%)	Total, <i>n</i> (%)	<i>P</i>
≤3	26 (10.7)	19 (16.2)	45 (12.5)	0.004
4–6	20 (8.3)	11 (9.4)	31 (8.6)	
7–9	100 (41.3)	54 (46.2)	154 (42.9)	
10–12	56 (23.1)	29 (24.8)	85 (23.7)	
13–15	40 (16.5)	4 (3.4)	44 (12.3)	
Total	242 (67.4)	117 (32.6)	359	

Fisher's exact.  
Values expressed in frequencies and percents.

general health and required mechanical ventilator support. Therefore, the total number of patients included in this study that were referred to the paediatric dental service due to dental trauma was 359.

Males predominated through all age groups, with a distribution of 242 males (67.4%) and 117 females (32.6%). Mean age was 8.4 years  $\pm$  3.49 SD (range = 1–15). The male:female ratio was 2:1. Details of age group distribution are shown in Table 2.

In Chile, there are two types of health insurance: Private and Government-based. In the latter, the Chilean National Health Insurance is a public institution that provides a partial or total health service provision to over 11 500 000 beneficiaries (70% of Chilean population) in public and private hospitals. The insured patients of National Health Insurance are classified into four groups: A, B, C and D, according to their income. Details about socioeconomic status and income characteristics according to the Chilean National Health Insurance as well as dental coverage for emergency attention for dental injuries are shown in Table 3.

Table 3. National Health Insurance Classification and Dental Coverage in Chile

Chilean National Health Insurance	Income criteria for Public Health System	Payment of dental treatment in public hospitals	Payment of Dental emergency	School Government Health Insurance
Group A	Poverty, lack of economic resources	Free of charge	Free of charge	Free of charge
Group B	Annual income $\leq$ USD 3036.00	30% institutional tariff	Free of charge	Free of charge
Group C	Annual income between USD 3036.00 and USD 4428.00	50% institutional tariff	10% institutional tariff	Free of charge
Group D	Annual income $\geq$ USD 4428.00	80% institutional tariff	20% institutional tariff	Free of charge

Table 4. Distribution of children with dental trauma according to income group levels (National Health Insurance)

National Health Insurance of Chile	Frequency	%
Group A	163	45.5
Group B	82	22.8
Group C	61	16.9
Group D	21	5.9
Private	32	8.9
Total	359	100

The majority of patients (68.3%) with dental injuries were classified under type 'A' or 'B' National Health Insurance. These groups correspond to patients with low educational levels and low family incomes. The distribution of children with dental trauma according to income group levels (National Health Insurance) is shown in Table 4. In Chile, patients with more economic resources usually seek treatment for dental trauma in the private healthcare system.

The majority of the sample (57.1%) suffered the accident at school (205/359). The mean age of children with dental trauma at school was 8.8 years  $\pm$  2.7 SD. Patients under 6 years of age with primary dentition presented the highest frequency of dental trauma at home ( $P < 0.000$ ) (Table 5).

From the 359 patients with dental trauma, 725 specific diagnoses were established; of these, 145 were in primary dentition and 580 were in permanent dentition. In both dentitions, upper maxillary central incisors were the most common affected teeth by trauma. In several cases, permanent teeth presented more than one diagnosis.

In the primary dentition, the most frequent diagnoses were luxation dental injuries. Of the injuries noted, 56 teeth presented with subluxation, 32 teeth presented with

Table 5. Distribution of children by location of accident and age. Observe the majority of the children aged 7–15 years suffered the accident at school

Age group	Location of accident			
	Home n %	School n %	Street n %	Others n %
≤3	31 (68.8)	7 (15.6)	7 (15.6)	–
4–6	7 (22.6)	19 (61.3)	2 (6.4)	3 (9.7)
7–9	16 (10.4)	108 (70.1)	29 (18.8)	1 (0.7)
10–12	8 (9.4)	48 (56.5)	23 (27.1)	6 (7.0)
13–15	6 (13.6)	23 (52.3)	13 (29.6)	2 (4.5)
Total	68 (19.0)	205 (57.1)	74 (20.6)	12 (3.3)

$P < 0.000$ .

Table 6. Distribution of different diagnosis of dental trauma and soft tissues injuries separated by primary and permanent dentition

Diagnosis	Primary dentition n (%)	Permanent dentition n (%)	Total
<b>Hard tissue injuries</b>			
UCF	08 (5.5)	191 (32.9)	199 (27.4)
CCF	04 (2.7)	32 (5.5)	36 (4.9)
Crown-root fracture	07 (4.8)	06 (1.0)	13 (1.8)
Root-fracture	05 (3.4)	31 (5.3)	36 (5.0)
Alveolar bone fracture	05 (3.4)	16 (2.8)	21 (2.9)
Sub-total	29* (20.0)	276* (47.6)	305 (42.1)
<b>Periodontal tissue injuries</b>			
Concussion/subluxation	56 (38.6)	184 (31.7)	240 (33.1)
Extrusive luxation	10 (6.9)	54 (9.3)	64 (8.8)
Lateral luxation	22 (15.2)	19 (3.3)	41 (5.6)
Intrusion	04 (2.7)	03 (0.5)	07 (1.0)
Avulsion	24 (16.6)	44 (7.6)	68 (9.3)
Sub-total	116* (80.0)	304* (52.4)	420 (57.9)
Total	145 100.0	580 100.0	725 100.0
<b>Soft tissues injuries</b>			
Peri-oral abrasions	13	56	69
Contusions (bruises and haematomas)	19	57	76
Lacerations of peri-oral skin and/or oral mucosa (tongue, lips, cheek, gingival)	14	73	87
Total	46	186	232 <sup>1</sup>

\*Fisher exact  $P = 0.000$ .  
In several cases, some permanent teeth presented over one diagnosis.  
<sup>1</sup>In several cases, some patients had more than one type of soft-tissue injuries.

luxations (extrusive and lateral luxation) and 24 teeth presented with avulsion. For permanent dentition, the most frequent diagnoses were uncomplicated crown fractures (UCF) and subluxation. In 34 cases of crown fractures in permanent dentition, the affected children usually brought the crown fragment into a glass of milk (22.8%).

The soft-tissues lesions in the oral cavity and peri-oral region were variable in both severity and extension. Of all children with dental trauma attended at the paediatric dental service, 141 patients (39.2%) presented combined lesions to oral soft tissues. There were more than one type of oral and peri-oral soft tissue injuries associated to dental trauma. Gingival, upper and lower lip wounds, peri-oral and nasal skin erosions were the most common soft-tissue injuries. Also, these patients presented with bruises, lacerations, hemorrhagic wounds and haematomas of the oral mucosa. Several patients presented multiple types of oral soft-tissues injuries simultaneously. The details and frequency of the different diagnoses registered for primary and permanent dentition, as well as lesions of oral soft-tissues are shown in Table 6.

Falls were the most frequent cause of dentoalveolar trauma among all of different age groups, especially in patients younger than six years of age and in the seven-to-nine year group. Overall, the most frequent causes of dental injury were nonspecific falls (51.8%), blows with an object (15.6%) and bike accidents (13.9%). Details regarding the different aetiologies of traumatic dental injuries distributed by age are shown in Table 7.

According to the time elapsed until the first emergency attention, a high percentage of patients received their initial emergency care within 2–24 h (45.7%), while the remainder of the sample received the emergency attention after 24 h (32.6%). Only 3.0% of the affected patients were treated in the emergency room within 30 min of the trauma (Table 8). Forty-four permanent teeth (7.6%) presented with avulsion. Of these teeth, only 30 were replanted in 21 patients (68.1%). The distribution was as follows: 15 patients with one avulsed tooth, four patients with two avulsed teeth, one patient with three avulsed teeth and one patient with four avulsed teeth. Storage and transport media were variable. The most common form of storage was in a dry transport medium, such as a napkin (13 patients); only four patients transported the avulsed tooth intra-orally. The

Table 7. Cause of dental injury distributed by age

Causes of injury	Years					Total n (%)
	0–3 n (%)	4–6 n (%)	7–9 n (%)	10–12 n (%)	13–15 n (%)	
Baby walker	2 (4.4)	0	0	0	0	2 (0.6)
Falls	38 (84.4)	20 (64.5)	78 (50.6)	41 (48.2)	9 (20.5)	186 (51.8)
Sports activities	1 (2.2)	2 (6.5)	15 (9.7)	4 (4.7)	9 (20.5)	31 (8.6)
Fight	0	1 (3.2)	3 (1.9)	2 (2.4)	5 (11.4)	11 (3.1)
Striking objects	1 (2.2)	5 (16.1)	29 (18.8)	13 (15.3)	8 (18.2)	56 (15.6)
Bicycle accident	1 (2.2)	2 (6.5)	17 (11.0)	19 (22.4)	11 (25.0)	50 (13.9)
Traffic Accident	2 (4.4)	0	8 (5.2)	6 (7.0)	1 (2.2)	17 (4.7)
Others	0	1 (3.2)	4 (2.6)	0	1 (2.2)	6 (1.7)
Total	45	31	154	85	44	359

Table 8. Distribution of patients by time elapsed before emergency treatment

	Time elapsed before emergency treatment	Total	%
1	<30 min	11	3.0
2	30–59 min	16	4.5
3	60–89 min	28	7.8
4	90–119 min	23	6.4
5	120 min–24 h	164	45.7
6	>24 h	117	32.6
	Total	359	100.0

Table 9. Distribution of replanted permanent teeth regarding store/transport medium and time of replantation. ( $n = 30$  teeth)

Time of replantation <sup>1</sup>	Store and transport medium				Total
	Saliva	Dried	Milk	Other	
Arrived replanted					0
<10 min		2			2
10–90 min	6	5	2		13
90 min–24 h		5	3	6	14
>24 h		1			1
Total	6	13	5	6	30

<sup>1</sup>Fourteen avulsed permanent teeth were not replanted.

majority of avulsed teeth were replanted (14 teeth) within 90 min to 24 h after the accident (Table 9).

## Discussion

Differences in the prevalence of dental trauma to primary and permanent dentition have been related to several factors, such as the type of study, the diagnosis classification, the affected age groups, sample composition, and behavioural and geographic differences (12, 13, 15, 21). Although multiples reports in the literature state that the types of dental trauma are similar in the populations, it is imperative that each community analyse the data for specific recommendations concerning prevention and management.

In Chile, there is a paucity of epidemiological data regarding dental injuries in children and adolescents. The first investigation regarding the characteristic of dental trauma in children and adolescents was published by Onetto et al. (18). The findings of that study are in agreement with our results regarding to sex distribution, the age group most affected by dental trauma (7–12 years), location and the main causes of dental trauma (e.g., falling, being struck with objects and bicycle accidents), the time elapsed to first attention and the type of dental trauma in primary (luxation injuries) and permanent dentition (crown fractures).

As in other reports, the highest number of patients with dental trauma fell within the 7- to 12-year-old group of children (1–3, 7, 11, 23). Also, regarding gender distribution, our results confirmed that males had an increased prevalence of dental trauma, as compared to females (2, 5, 7, 9, 11, 21, 24). This might be explained, in part, by the fact that boys participate in more dangerous,

aggressive games and contact sport activities (23, 24). However, other studies have shown a reduction in the gender difference, possibly due to increased sports activities among girls and the characteristic of modern Western society (5, 25).

Different reports vary concerning the main causes of dental injuries. There is, however, concurrence that unspecified accidental falls are the most common cause of dental injury in all age groups, followed by bicycle accidents, strikes with objects and recreational sports activities (9, 18, 21, 24, 26).

The association between age and the aetiology of dental injuries can be explained by age-related activities and the characteristics of motor coordination development. The finding of unspecified falls as the primary aetiology of dental trauma in the 0- to 5-year-old group are attributed to poor motor coordination, specifically in children younger than three years-old (1, 18, 26). In the other age range, between 7–15 years, bike accidents and sports recreational activities show a notable increase (9, 10, 18–21). In a report by Acton et al. (34), 31% of children under 15 years of age with facial injuries as a result of bicycle accident had different dental trauma. They stated that children are on high risk of dental trauma due to lack of protection of the lower face and teeth. Despite multiple educational campaigns carried out in various cities of Chile regarding dental trauma in children, there is, regrettably, still no evidence of prevention of dental trauma culture well-developed, especially in the high risk groups, such as school children and adolescents that perform contact sports, use skateboards and ride bicycles. Commonly these children do not wear mouth guards, helmets, knee-pads and/or elbow pads, especially in deprived social/economic groups.

In this study, the majority of sufferers' population corresponded to patients with the lowest family income classification, which usually is associated with low parental education levels. This characteristic is similar to that found by Marcenes & Murray, where traumatic dental injuries seem to be a serious dental public health problem among children in deprived areas where dangerous environmental conditions such as, overcrowding, unsafe playgrounds and sports facilities are important environmental factors related to dental injuries (27–29). A review by Glendor, stated that environmental and behavioural factors will probably become of greater importance in the occurrence of dental trauma (5, 29).

In agreement with previous reports, this study showed that the main location for dental injuries in children 0–6 years of age was at home (50%) while in school-aged children (the 7- to 12-year-old group), with mixed dentition suffered more dental trauma (63.2%) at school (18, 19). At school, the most frequent causes of dental injury were falls (57.8%), being struck with objects and sports activities (12.2%). In this study there was a statistically significant relationship between age, gender and location of injury ( $P < 0.05$ ).

Similar to other national and international studies, we observed that in both primary and permanent dentition, the maxillary central incisors were the most common compromised teeth, with 62.8% and 75.5% of injuries

occurring to these teeth, respectively (6–9, 18, 21). These results are noteworthy because inadequate or delayed first emergency attention could lead to functional, aesthetic and psychological sequelae, especially regarding permanent dentition. Although a great number of studies have shown the limited risk for pulp complications in uncomplicated crown fractures, especially in cases of no additional concomitant to periodontal ligament injuries (PDL) (30), timely treatment is advisable for aesthetic and psychological reasons. In a report by Hamilton et al. (31), the authors stated that abnormal visual aspects of the oro-facial structures play an important role in the development of abnormal psychosocial behaviour. Other reports stated that there is no significant relationship between immediate treatment and delayed treatment in regards to pulp complications in teeth with crown fractures (32). However, histological characteristics such as multiple wide dentinal tubules, which have a high risk of bacterial penetration to the pulp should be considered (30, 33).

The most frequent injury of hard tissues in permanent dentition was uncomplicated crown fractures (32.9%), which is in agreement with other reports (3, 7, 18, 23). However, in comparison with these same reports, our study showed a high frequency of periodontal tissue injuries such as subluxation (31.7%) in permanent dentition; this is most likely due to the high resilience of alveolar bone in children aged 7–12. In this study, 51 of 223 (23%) patients with crown fractures at the permanent incisors arrived to the emergency service with the crown fragment stored into a napkin, handkerchief or tissue or into a glass of water. This result would show the effects of various educational campaigns regarding the emergency management of dental trauma in school children that we have carried out. However, it is still necessary to educate the population in regard to the clinical importance of retrieving the tooth fragment.

In this study, as in several lines of research (1, 7, 18) the most common injuries to primary dentition are those compromising the supporting tissues, like subluxation, lateral luxation and avulsion (70.4%). Other reports state that minor injuries to the PDL, such as concussion and subluxation, often go unreported, probably due to the presence of less compromised tissue with little or no bleeding wounds and consequent parent reluctance to seek treatment (32).

Of the 145 injured primary teeth, 30.5% (44 of 145) were lost, either by avulsion (16.6%) at the moment of the accident or extraction due to development of pulp and/or periodontal complications. The loss of injured primary teeth was due to the following factors: (i) impossibility of restorative treatment, (ii) poor prognosis, (iii) non-cooperative patient and (iv) desire to avoid or minimize the risk of damage to the permanent tooth germ (1). The replantation of avulsed primary teeth is contraindicated due to risk of complications, such as the development of dental abscess, pain, mobility, root resorption, danger of aspiration to respiratory tract and a high risk of major damage to developing tooth germ.

It is currently known that favourable healing after avulsion in permanent teeth requires a quick emergency intervention. It is clear that special emphasis should be

given to non-dental professional emergency attention. In this study, 34% (15/44) of avulsed permanent teeth were replanted during emergency visits that occurred within 90 min of the accident. A short extra-alveolar period is critical for pulp and periodontal healing; therefore, immediate replantation by medical personnel, parents and lay people who are in daily contact with children and others persons at the site of the accident is indicated (30, 35–39). Another critical factor for a successful outcome in replantation of avulsed young permanent teeth is the storage and transport medium before arrival at the emergency room. According to Tzigkounakis et al. (39), a great number of replanted teeth (80%) were incorrectly stored and transported in a non-physiological medium, such as dry storage (e.g. napkin, handkerchief or cloth), a glass of water or glucosaline solution. In many situations the emergency management of dental trauma in polytraumatised patients is not the priority. These patients, thus, received delayed first emergency dental care.

Generally, traumatic dental injuries in children and adolescents are associated with damage to surrounding oral soft-tissues. In some reports, lesions to oral soft-tissues are present in almost half of all dental trauma patients (17, 40). In other studies, soft tissue injuries are seen in one-third of all patients that seek emergency treatment for oral injuries. In this study, the prevalence (39%) of patients with oral soft-tissues injuries was similar to previous reports (41, 42). Because the soft-tissue oral injuries result in bleeding and oedema, they lead to high anxiety in the parents and appear to motivate early emergency treatment.

Since 55% of the dental injuries occurred at school, it is advisable to educate school teachers, physical education teachers, school nurses, secretaries and parents about emergency management of avulsed permanent teeth.

Similar to other reports, a high percentage of affected patients were treated, in delayed form, even 24 h after the accident (9, 18, 43). Since all dental injuries could produce pulp and/or periodontal ligament healing complications, it seems logical to prevent them by timely and appropriate management and follow-up. The delay in initial emergency treatment might be due to: (i) the high frequency of patients referred from other cities, (ii) the lack of a dentist, paediatric dentist, and/or maxillofacial surgeon at this emergency unit on the weekends and after-hours, (iii) the request for initial emergency management at the Primary Health Centre, with later referral to the Hospital Centre with no treatment and (iv) in polytraumatised patients the emergency management of dental injuries is not the priority.

Non-dentist clinicians, health administrators, and coordinators of emergency health care services should also be made aware of the management of dentoalveolar injuries in children and adolescents, since their attention to this would allow for adequate emergency room functioning by competent professionals and for timely attention in cases of dental trauma (44, 45). Additionally, it is of paramount importance that other professionals and paramedic technicians be knowledgeable concerning the most common types of dental trauma in schoolchild-

dren and adolescents, since this would allow these professionals to engage in better clinical emergency management procedures (9).

### Conclusions

Herein, we show that dental trauma is common in children, since a high frequency (37.9%) of patients ranged 1–15 years of age sought emergency attention by dental trauma at a public hospital. The characteristics of dental trauma observed in this group of children and adolescents were very similar to the results of other studies regarding gender distribution, location of the accident, the most common of traumatic dental trauma in primary and permanent dentition, the main causes of dental trauma and the time elapsed before the first emergency care. Across all age groups, we found that males showed a higher frequency (67.4%) of dental trauma than females (32.6%). The largest age group with dental trauma (66.6%) corresponded to the 7- to 12-year-old group. School is the most common location where dental injuries occurred (57.1%). The most common types of injury in the primary dentition were subluxation (38.6%) and avulsion (16.6%) and in the permanent dentition, the most common injuries were crown fractures (38.4%). In both dentitions, maxillary incisors were the most affected teeth. Regarding aetiology, we showed that the main causes of dental trauma were unspecific falls (51.8%), struck with objects (15.6%) and bike accidents (13.9%). One-third of the affected patients received first emergency attention after 24 h (32.6%). According to data concerning the emergency management of avulsed permanent teeth, lay persons and/or adults people who are in daily contact with children clearly lack sufficient knowledge regarding the importance of immediate replantation as well as of the appropriate storage and transport medium of the compromised teeth.

In agreement with other reports this study shows that the highest frequency of dental trauma occurred in children of a low educational level and low family income. In these populations, is necessary to investigate the factors that increase the risk of dental trauma, in order to develop effective preventive and educational strategies especially in cases of avulsed permanent teeth and the subsequent appropriate first emergency attention at the accident site.

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