Dental Traumatology

Dental Traumatology 2011; **27**: 368–373; doi: 10.1111/j.1600-9657.2011.01011.x

Retrospective study of traumatic dental injuries in primary teeth in a Brazilian specialized pediatric practice

Lilian de Fátima Guedes de Amorim[1], Luciane Ribeiro Resende Sucasas da Costa[1], Carlos Estrela[2]

[1]Department of Prevention and Oral Rehabilitation, Faculty of Dentistry, University of Goiás; [2]Department of Stomatologic Sciences, Faculty of Dentistry, University of Goiás, Goiânia, GO, Brasil

Correspondence to: Dra. Lilian de Fátima Guedes de Amorim, Department of Prevention and Oral Rehabilitation, Faculty of Dentistry, Federal University of Goiás, Avenida Universitária esquina com 1a. Avenida, s/n, Setor Universitário, 74605-220 Goiânia, GO, Brazil
Tel./Fax: +55 62 40092200
e-mail: lilianguedes31@terra.com.br

Accepted 4 April, 2011

Abstract – *Objective:* To determine the prevalence of traumatic dental injuries (TDI) in children younger than 7 years and the effect of predisposing clinical factors on their occurrence. *Material and methods:* Dental records of 2725 children younger than 7 years seen in a private pediatric dental clinic in Goiânia, Brazil, from February 1993 to December 2008 were analyzed. A group of 150 children without traumatic injuries and with similar characteristics to those of the trauma group were used to study predisposing clinical factors as follows: lip coverage (adequate/inadequate), overbite (normal/negative/deep), and overjet (less or greater than 3 mm). Frequency distribution and a chi-square test were used for data analysis. The level of significance was set at 5%. *Results:* Clinical and radiographic data of 412 injured deciduous teeth were found in 383 records. TDI prevalence was 11.9%, with no significant difference between sexes. The maxillary central incisors were the teeth most frequently affected (83.3%), and the most frequent type of injury was subluxation (35.1%). TDI was most prevalent in the 13-to-36-month age group (47.7%). Home (43.5%) was the main place of occurrence, followed by school (10.1%); falls (50.3%) were the most common cause, followed by collisions with objects (18.2%). The first examination or treatment occurred in the first 24 h in 46.5% of the cases. The analysis of the association of predisposing clinical factors with TDI revealed no differences in lip coverage; however, overjet >3 mm and deep and negative overbite were significantly associated with TDI. *Conclusion:* TDI in primary dentition should receive careful attention, particularly when it affects children younger than 3 years and in the presence of overjet, overbite, or both.

Traumatic dental injuries (TDI), one of the main reasons why patients seek emergency dental treatment, are frequent and may have serious consequences (1–3). In preschool children, head trauma accounts for 40% of the injuries, and one-third of these lesions affect the face (2).

Reports about TDI in different countries show a wide variation in its frequency rates (3–8). Some of these values may be underestimated because many children with mild dental injuries do not seek care or do not receive an accurate diagnosis (9). In Brazil, TDI has become more frequent (10) and is now a public health problem, not only because of its prevalence, but also because of its negative impact on quality of life (11) and the high cost of its treatment (12, 13).

Dental trauma in primary teeth may cause pain and loss of function and may also affect the development of permanent teeth and occlusion, which may result in physical, emotional, and behavioral problems for the children and their parents or guardians (14, 15).

Several factors predispose to TDI in primary teeth. For a long time, sex and age were considered the main risk factors, but currently other factors, such as the type of activity at the time of the accident and biological, environmental, behavioral, and socioeconomic factors, have received greater attention (3, 16–18). Studies have associated a high prevalence of TDI with pronounced overjet, anterior open bite, inadequate lip coverage (18–21), behavioral disorders (stress and panic), systemic problems (obesity and epilepsy), socioeconomic factors (16, 17, 21, 22), attention deficit, hyperactivity disorder (23).

The prevalence of TDI in primary dentition should be defined to support preventive and therapeutic planning. According to Mjör et al. (24), the impact of dental research on dental practice in the past 50 years has not been commensurate with the resources committed to it, very likely because of the gap between research and practice. The improvement of clinical practices depends on the result of rigorously controlled studies conducted by specialists experienced in research.

This study examined dental trauma in primary dentition to determine its prevalence and association with predisposing clinical factors in children younger than 7 years treated at a private clinic.

Materials and methods

This study retrospectively examined 2725 dental records of children aged 0–7 years seen in a pediatric dental clinic in Goiânia, Brazil, from February 1993 to December 2008. Participants had a similar socioeconomic condition: Their parents or guardians owned their homes; they had a babysitter for the children; at least one of them had finished college; and their children attended private schools. Inclusion criteria were as follows: history of trauma in any deciduous tooth; at least 12 months of clinical and radiographic follow up; and patient charts correctly filled out.

Data about patient age and sex, place where TDI occurred, activity during the accident and time between trauma and initial dental care were collected by a single dentist for the first dental trauma only. TDI was classified according to the system adopted by the World Health Organization and modified by Andreasen and Andreasen (1). As this system had no category for more than one type of TDI in a single accident, these teeth were classified as 'combined' in this study. Teeth with a history of dental injuries on different dates were classified as 'recurrent'.

To determine prevalence of predisposing clinical factors among children with and without traumatic injury, a second group of 150 children with no history of TDI in deciduous dentition were selected from the 2725 records in the same clinic. This no-trauma group had the same age and sex distribution as the trauma group. The data analyzed in both groups were as follows: type of lip coverage, overjet, and overbite classified according to the system described by Proffit and Fields (25).

Overjet was recorded as the distance between the buccal surface of the mandibular incisors and the incisal edge of the maxillary incisors with a millimeter ruler place perpendicularly to the teeth and classified as ≤3 or >3 mm. Lip coverage was classified as normal when the upper lip touched the lower lip. Overbite was divided into three categories as follows: (i) normal – the incisal edge of the maxillary incisors covered up to 2 mm of the buccal surface of the mandibular incisors; (ii) deep – it covered 3 mm or more of the buccal surface of the mandibular incisors; and (iii) negative – the maxillary incisors were on top of mandibular incisors or the patient had an open bite (25).

A database using the *MySQL* platform with a PHP front end was created especially for this study (26).

A pilot study examined 54 dental records. This study was approved by the Research Ethics Committee of the Federal University of Goiás (no. 117/2008).

Statistical analysis

The statistical analysis was performed using the SPSS for Windows 17.0 (SPSS Inc., Chicago, IL, USA) and evaluated frequency distribution and associations. A chi-square test was used to determine the statistical significance of associations between variables. The level of significance was set at 5%.

Results

TDI in primary teeth was found in 325 children seen in a private pediatric dental clinic, which resulted in a prevalence rate of 11.9%. Seventeen dental records were excluded from further analyses because they did not clearly identify the type of trauma. The final sample included 308 children (11.3%); 145 (47.1%) were girls, and there were no statistical differences between sexes ($P = 0.30$). Ages ranged from 4 months to 7 years (mean ± SD = 3.8 ± 1.6 years). Two hundred and fifty-six children (83.1%) had only one trauma, whereas 52 (16.9%) had a history of recurrence.

The highest frequency was found in the groups of children of 13–24 months and 25–36 months of age. Chi-square tests demonstrated the following differences among the age groups (Table 1): TDI cases in 'up to 12 months' were less frequent than in '13–24 months' ($P < 0.001$); the frequencies for '13–24 months' and '25–36 months' ($P = 0.934$), '25–36 months' and '37–48 months' ($P = 0.092$), '37–48 months' and '49–60 months' ($P = 0.264$) did not differ; the age group '61–72 months' had less TDI cases than the '49–60 months' ($P = 0.041$) but did not differ from the '73 months or more' group ($P = 0.297$). Trauma was seen in 412 primary teeth. The maxillary central incisors were the teeth most frequently affected (83.3%), followed by the maxillary lateral incisors (11.0%), mandibular central and lateral incisors (3.7%); canines (0.9%) and molars (1.1%).

The analysis of number of injured teeth in each incident revealed that 62.3% of preschool children had TDI in one tooth, 31.2% in two teeth, 5.5% in three teeth, and 1.0% in four teeth. There was no statistical difference in the seasonal distribution of TDI: 79 cases (25.6%) occurred in the summer, 79 (25.6%) in the spring, 77 (25.1%) in the winter, and 73 cases (23.7%) in the fall. Home was the place where most TDI occurred (134; 43.5%), followed by the school (31; 10.1%) and the club/park (28; 9.1%). The most common causes of dental trauma were as follows: falls (155; 50.3%), collisions with objects (56; 18.2%), sports activities (6; 1.9%), and bicycle accidents (5; 1.6%). Location and activity were unknown in the other records.

The most frequent injury site was the periodontal tissue (297; 72,1%), and subluxation ($n = 166$) was the most common type of TDI (40.3%). In the hard dental tissue and pulp ($n = 96$), the most frequent TDI was enamel fracture ($n = 54$). Combined traumas, which affected more than one type of hard dental tissue and pulp or periodontal hard tissues, or the association

Table 1. Distribution of traumatic dental injuries according to age

	Dental trauma*	
Age	*n*	%
Up to 12 months	19	6.2
13 to 24 months	74	24.0*
25 to 36 months	73	23.7*
37 to 48 months	54	17.5
49 to 60 months	43	14.0
61 to 72 months	26	8.4
73 months or more	19	6.2

Chi-square test *P < 0.05.

between these two types, was found in 4.1% (n = 19) of the cases: 47.1% of them (n = 9) had subluxation associated with crown fracture of enamel and dentin. The prevalence of the different types of TDI is shown in Fig. 1.

Table 2 describes the time elapsed from the accident to the time when treatment was sought. This information was found in 269 records: 125 (46.5%) sought treatment within the first 24 h; of these, 65 (24.2%) sought treatment in 2 h or less.

The analysis of TDI and predisposing clinical variables, which included the records that provided this information, revealed that there was no difference in lip coverage between the trauma and the no-trauma groups (P = 0.35); in the two groups, the most prevalent condition was appropriate lip coverage: 68.4% and 73.4%. A significant difference was found in overjet (P = 0.001) and overbite (P = 0.01) comparing the trauma and no-trauma groups: Regarding the overjet, the trauma group had more children with overjet (>3 mm); concerning the overbite, the trauma group included more children with negative overbite. The prevalence of these variables in the two groups is shown in Table 3.

Discussion

TDI is currently seen as a public health problem because of its frequency and its wide occurrence among young patients during growth and development. Moreover, its treatment is often complex and expensive, and there may be irreversible sequelae, which will require treatment over the patient's entire life (1, 3, 13, 15). The prevalence of TDI in this study was 11.9%. Few studies using data about private dental clinics have been conducted (27). This rate is an important parameter for other researchers in clinical practice and shows that, in general practice and pediatric dentistry, professionals should be prepared to treat and provide information about the prevention of trauma in children. Studies, however, should be cautiously compared because of the differences in type of study, classifications, methods, age groups, as well in geographical, socioeconomic, and behavioral differences between regions and countries.

Gender has been pointed out as a predisposing factor in dental trauma (1), and several studies found a greater prevalence of trauma among male patients (5, 6, 21, 28, 29). In this study, as in those conducted by other authors (4, 7, 18, 19, 22), no statistically significant difference was found in the distribution of trauma between genders. Study about the association of education and sex (30) recommend that from an early age, children should be encouraged to try and have the chance to do whatever they want, regardless of sex. At the same time, psychology has proved that the personalities of boys and girls are no longer at opposite poles. In the past, boys were agitated, aggressive, and undisciplined, and girls, calm and obedient, which may have resulted in higher trauma rates among boys in earlier decades.

Age is a well-documented risk factor, and although TDI has been observed in all age groups, studies with preschoolers have shown that more lesions occur in the group of children aged 13–36 months (15, 21, 27). These results are in agreement with our findings. Children of 13–36 months old accounted for 47.7% of all TDI, probably because at this age children are gaining mobility and independence, but still have little motor coordination. Preventive strategies should be adopted for this age group because children up to 36 months old are unique in terms of the speed of their growth and development. This increases the risk of TDI in general and the severity of sequelae (31).

The most commonly affected teeth, both in deciduous and permanent dentition, are the maxillary incisors (14, 16, 32, 33), and our study findings confirm it. One possible explanation for this is the protective effect of the maxilla on the mandible during occlusion and the fact that the maxilla is rigidly fixed to the cranium, while the mandible is flexible, which tends to reduce the force of impact (5, 18).

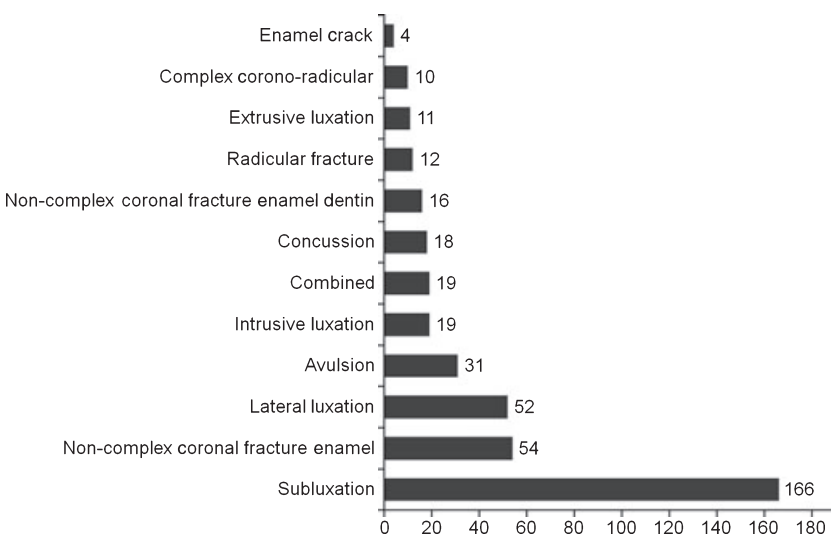

Fig. 1. Distribution of dental injuries (n) according to type of traumatic dental injuries.

Table 2. Time elapsed between injury and initial treatment

Time elapsed	*N* (%)
Not reported	185 (40.7)
Up to 2 h	65 (14.3)
2 to 24 h	60 (13.2)
1 to 7 days	55 (12.1)
8 to 30 days	42 (9.2)
1 to 6 months	22 (4.9)
7 to 12 months	18 (4.0)
>12 months	07 (1.6)

Table 3. Absolute (*n*) and relative (%) frequency of predisposing clinical variables in groups with and without TDI

	Trauma		
Variables	Yes – *n* (%)	No – *n* (%)	*P**
Lip coverage	171 (100%)	128 (100%)	0.35
Adequate	117 (68.4%)	94 (73.4%)	
Inadequate	54 (31.6%)	34 (26.6%)	
Overbite	188 (100%)	106 (100%)	0.01
Normal	63 (33.5%)	53 (50.0%)	
Negative*	61 (32.5%)	21 (19.8%)	
Deep	64 (34.0%)	32 (30.2%)	
Overjet	229 (100%)	112 (100%)	0.001
≤3 mm	107 (46.7%)	73 (65.2%)	
>3 mm*	122 (53.3%)	39 (34.8%)	

TDI, traumatic dental injuries.
Chi-square test *$P < 0.05$.

As demonstrated before (4, 7, 27), a high number of TDI involved only one tooth, which may be explained by the individual characteristics of the child's oral cavity and to the fact that multiple dental injuries are associated with sports, violence, and traffic accidents, infrequent in this age group.

Unlike other studies (5, 27, 32, 34), which reported an increase in the frequency of dental trauma in the summer months and at the start of the school year, when children tend to have more contact activities, no seasonal differences in the occurrence of dental trauma were found in this study. Goiânia is in a tropical region where there are few climate differences between seasons, and outdoor and contact activities are practiced all year round.

According to Glendor (17), the environment and the type of activities are the most important factors in TDI occurrence. In agreement with other studies (19, 22, 27, 33, 34), the most frequent cause of trauma in our study was falls, followed by collision with objects. The places where most injuries occurred were the home and the school. Therefore, educational programs should be developed to teach parents and teachers how to prevent falls and provide first aid in TDI, an economic measure as well as a form to promote better oral health.

TDI involved periodontal tissue three times more frequently than hard dental tissue and pulp, a result also found in other studies (5, 8, 14, 19, 29, 35). This may be explained by the resilience of the alveolar bone, the elasticity of the periodontal ligament, the crown-to-root proportion, and the root resorption (32, 33). The most frequent type of trauma was subluxation, which confirms the results of previous studies (8, 14, 19, 33). Other studies (7, 16, 18, 21) found that the most prevalent sites were hard dental tissue and the pulp. These differences may be explained by the methods, examination procedures, and diagnostic criteria adopted in different studies.

Mild trauma, such as concussion and subluxation, is not frequently reported because they are less serious and heal faster, which results in parents not seeking treatment (9). However, the parents' decision to seek treatment for TDI, even in mild cases or cases with little bleeding, may have been affected by the fact that this study was conducted in a pediatric dental clinic that treats children from middle and high socioeconomic classes. In studies conducted in private practices, enamel fractures that have not been examined by a dentist immediately after TDI or whose accident history has not been recorded tend to be undernotified because a differential diagnosis cannot be made, and the cause, trauma, or habit (bruxism, onychophagia) cannot be defined.

The injuries classified in this study as 'recurrent' are a complicating factor of trauma in permanent tooth and may lead to greater treatment complexity and increased costs (36). Few studies examined the recurrence of TDI in primary teeth; Assunção et al. (37) only mention its prevalence. A significant number of recurrent injuries were found in our study. Further studies should evaluate what factors are associated with TDI recurrence.

Glendor (3) suggests that behavioral disorders, emotional stress, learning difficulties, illnesses, and physical disabilities affect TDI recurrence. Although no studies in the literature investigated it in primary teeth, dental practice has shown that there might be an association between recurrent trauma and the appearance of sequelae in primary teeth, which justifies a more careful follow up of these cases and future studies to identify risk factors and methods of preventing recurrent TDI.

The analysis of clinical predisposing variables revealed that overjet and overbite showed significant differences in TDI occurrence. The association with lip coverage was not significant, but, according to Côrtes et al. (38), adequate lip coverage is an important protection mechanism for both deciduous and permanent teeth. Robson et al. (21) reported that the lack of adequate lip coverage results in a 1.95 times greater chance of dental trauma, while Jorge et al. (22) pointed out that lip coverage is not significant in trauma prevalence. The Swedish Council on Technology Assessment in Health Care (SBU-2005) (39) concluded, on the basis of a systematic review, that lack of lip protection is a greater risk among children with a pronounced overjet. According to Oliveira et al. (18), open bite is an important risk factor for TDI, and its presence doubles TDI frequency. Therefore, malocclusions and their causes should be diagnosed and treated early. Overjet >3 mm and negative overbite in this age group are predominantly associated with non-nutritive sucking habits and may be spontaneously corrected when the habit is broken (40–42), which may avoid trauma and its sequelae. The prevention of

non-nutritive sucking habits benefits oral appearance and functions and preserves the physical and psychological development of children without interfering with their social life.

The results of studies about TDI risk factors point to the need to investigate the interaction between oral, environmental, and behavioral factors (10, 17).

Clinical practice has shown that, in severe TDI, a long interval between trauma and seeking treatment may be an aggravating factor. In only 24.1% of cases in this study, treatment was sought within 2 h. The mean wait time for treatment varies widely (5, 19, 27), probably caused by the population's limited awareness of the consequences of dental trauma, the difficult access to dental services, and the low efficacy of treatment of injured teeth (22, 28, 35).

The prevalence of TDI in deciduous teeth in the population under study was not high, which may be associated with the sample's socioeconomic and environmental characteristics: Children supervised by babysitters have a lower risk of falls because they are less exposed to dangerous situations; their parents' educational level suggested that they knew how to prevent TDI; and the clinic where the data were collected was specialized in pediatric dentistry and provided information about accident prevention. Epidemiological studies with different populations should be conducted to test the hypotheses raised here. Given the lack of information about preventive measures against falls in the home and the school and about how to provide first aid, educational campaigns reaching wide segments of the population should be promoted. Moreover, specialized treatment services should be offered to all the population, and health professionals should be better prepared to deal with dental trauma in primary teeth.

References

1. Andreasen JO, Andreasen FM. Textbook and color atlas of traumatic injuries to the teeth, 3rd edn. Copenhagen: Munksgaard. 1994. 151–80 p.
2. Flores MT. Guidelines for the management of traumatic dental injuries. III. Primary teeth. Dental Traumatol 2007;23:196–202.
3. Glendor U. Epidemiology of traumatic dental injuries – a 12 year review of the literature. Dent Traumatol 2008;24:603–11.
4. Kramer PF, Zembruski C, Ferreira SH, Feldens CA. Traumatic dental injuries in Brazilian preschool children. Dent Traumatol 2003;19:299–303.
5. Eyuboglu O, Yilmaz Y, Zehir C, Sahin H. A 6-year investigation into types of dental trauma treated in a paediatric dentistry clinic in Eastern Anatolia region, Turkey. Dent Traumatol 2009;25:110–4.
6. Al-Jundi SH. Dental emergencies presenting to a dental teaching hospital due to complications from traumatic dental injuries. Dent Traumatol 2002;18:181–5.
7. Hargreaves JA, Cleaton-Jones PE, Roberts GJ, Williams S, Matejka JM. Trauma to primary teeth of South African preschool children. Endod Dent Traumatol 1999;15:73–6.
8. Borssén E, Holm AK. Treatment of traumatic dental injuries in a cohort of 16-year-olds in northern Sweden. Endod Dent Traumatol 2000;16:276–81.
9. McTigue DJ. Diagnosis and management of dental injuries in children. Pediatr Clin North Am 2000;47:1067–84.
10. Cunha Bonini GAV, Wagner M, Oliveira LB, Sheiham A, Bönecker M. Trends in the prevalence of traumatic dental injuries in Brazilian preschool children. Dent Traumatol 2009;25:594–8.
11. Berger TD, Kenny DJ, Casas MJ, Barrett EJ, Lawrence HP. Effects of severe dentoalveolar trauma on the quality-of-life of children and parents. Dental Traumatol 2009;25:462–9.
12. Borum MK, Andreasen JO. Therapeutic and economic implications of traumatic dental injuries in Denmark: an estimate based on 7549 patients treated at a major trauma centre. Int J Paediatr Dent 2001;11:249–58.
13. Glendor U, Jonsson D, Halling A, Lindqvist K. Direct and indirect costs of dental trauma in Sweden: a 2-year prospective study of children and adolescents. Community Dent Oral Epidemiol 2001;29:150–60.
14. Sennhenn-Kirchner S, Jacobs HG. Traumatic injuries to the primary dentition and effects on the permanent successors – a clinical follow-up study. Dent Traumatol 2006;22:237–41.
15. Altun C, Cehreli ZC, Güven G, Acikel C. Traumatic intrusion of primary teeth and its effects on the permanent successors: a clinical follow-up study. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2009;107:493–8.
16. Feldens CA, Kramer PF, Vidal SG, Faraco Junior IM, Vítolo MR. Traumatic dental injuries in the first year of life and associated factors in Brazilian infants. J Dent Child 2008;75:7–13.
17. Glendor U. Aetiology and risk factors related to traumatic dental injuries-a review of the literature. Dent Traumatol 2009;25:19–31.
18. Oliveira LB, Marcenes W, Ardenghi TM, Sheiham A, Bönecker M. Traumatic dental injuries and associated factors among Brazilian preschool children. Dent Traumatol 2007;23:76–81.
19. Avsar A, Topaloglu B. Traumatic tooth injuries to primary teeth of children aged 0–3 years (Turkey). Dental Traumatol 2009;25:323–7.
20. Nguyen QV, Bezemer PD, Habets L, Andersen BP. A systematic review of the relationship between overjet size and traumatic dental injuries. Eur J Orthod 1999;25:503–15.
21. Robson F, Jorge MLR, Bendo CB, Vale MP, Paiva SM, Pordeus IA. Prevalence and determining factors of traumatic injuries to primary teeth in preschool children. Dent Traumatol 2009;25:118–22.
22. Jorge KO, Moysés SJ, Ferreira FE, Jorge MLR, Zarzar PMA. Prevalence and factors associated to dental trauma in infants 1–3 years of age. Dent Traumatol 2009;25:185–9.
23. Avsar A, Akbas S, Atalbis T. Traumatic dental injuries in children with attention deficit/hyperactivity disorder. Dental Traumatol 2009;25:484–9.
24. Mjör IA, Gordan VV, Abu-Hanna A, Gilbert GH. Research in general practice. Acta Odontol Scand 2005;63:1–9.
25. Proffit WR, Fields H. Ortodontia Contemporânea, 3rd edn. Rio de Janeiro: Guanabara Koogan; 2002. 596 p.
26. Welling L, Thomson L. PHP and MySQL Web development, 1st edn. Indianapolis, IN, USA: Sams; 2004.
27. Garcia-Godoy F, Garcia-Godoy F, Garcia-Godoy FM. Primary teeth traumatic injuries at a private pediatric dental center. Endod Dent Traumatol 1987;3:126–9.
28. Ekanayake L, Perera M. Pattern of traumatic dental injuries in children attending the University Dental Hospital, Sri Lanka. Dent Traumatol 2008;24:471–4.
29. Sandalli N, Cildir S, Guler N. Clinical investigation of traumatic injuries in Yeditepe University, Turkey during the last 3 years. Dent Traumatol 2005;21:188–94.
30. Carvalho MP. Sucesso e fracasso escolar: uma questão de gênero. Educação e Pesquisa 2003;29:185–93.
31. Agran PF, Anderson C, Winn D, Trent R, Walton-Haynes L, Thayer S. Rates of pediatric injuries by 3-months intervals for children 0 to 3 years of age. Pediatrics 2003;111:683–92.
32. Saröglu I, Sönmez H. The prevalence of traumatic injuries in the pedodontic clinic of Ankara University, Turkey, during 18 months. Dent Traumatol 2002;18:299–303.

33. Skaara AB, Jacobsen I. Primary teeth injuries in Norwegian children (1–8 years). Dent Traumatol 2005;21:315–9.
34. Kargul B, Cağlar E, Tanboga I. Dental trauma in Turkish children, Istanbul. Dent Traumatol 2003;19:72–5.
35. Gábris K, Tarján I, Rózsa N. Dental trauma in children presenting for treatment at the Department of Dentistry for Children and Orthodontics, Budapest, 1985–1999. Dent Traumatol 2001;17:103–18.
36. Pissiotis A, Vanderas AP, Papagiannoulis L. Longitudinal study on types of injury, complications and treatment in permanent traumatized teeth with single and multiple dental trauma episodes. Dental Traumatol 2007;23:222–5.
37. Assunção LRS, Ferelle A, Iwakura ML, Cunha RF. Effects on permanent teeth after luxation injuries to the primary predecessors: a study in children assisted at an emergency service. Dent Traumatol 2009;25:165–70.
38. Côrtes MIS, Marcenes W, Sheiham A. Prevalence and correlates of traumatic dental injuries to the teeth of schoolchildren aged 9 to 14 in Belo Horizonte, Brazil. Endod Dent Traumatol 2000;17:22–6.
39. SBU (2005). Swedish Council on Technology Assessment in Health Care (SBU). http://www.find-health-articles.com [accessed on 10 December 2009].
40. Ovsenik M, Farcnik FM, Korpar M, Verdenik I. Follow-up study of functional and morphological malocclusion trait changes from 3 to 12 years of age. Eur J Orthod 2007;29:523–9.
41. Leighton BC. The early signs of malocclusion. Eur J Orthod 2007;29:189–95.
42. Heimer MV, Katz CRT, Rosenblatt A. Non-nutritive sucking habits, dental malocclusions, and facial morphology in Brazilian children: a longitudinal study. Eur J Orthod 2008;30:580–5.