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Traumatic injuries of the permanent incisors in children in southern Turkey: a retrospective study

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Abstract –The aim of this study is to investigate the incidence, etiologic factors and results of dental trauma and the effects of age and gender on the trauma in permanent incisors. Over a 3-year period, 514 permanent incisor teeth in 317 patients with trauma history, who applied to Süleyman Demirel University School of Dentistry, Department of Pedodontics from the southern cities of Turkey, were evaluated. Standardized trauma forms were filled for each patient. In all age groups, the most frequent cause of trauma was found to be unspecified falls (47.6%). Maxillary teeth (88.5%) and central incisors (87.5%) were the most affected teeth from dental trauma. Ellis class II crown fracture was the most frequently seen type of injury (43.8%). The percent of the patients who applied to a dental clinic in the first 3 days after the trauma occurred (22.8%) was less than the percent of the patients who applied after 3 months and more time period (45.1%). It reveals that it is important to inform the public about dental trauma and the importance of time in these cases.

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Key words: dental; trauma; injury; permanent incisors; retrospective study

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Traumatic injuries of permanent incisors and their supporting structures, which occur because of different reasons, constitute a true dental emergency and require immediate assessment and management, because many young, permanent teeth continue their development in those ages (1–3).

The patients, who are exposed to trauma, are not only physically, but also psychologically affected (4). Dental trauma is also a source of distress for the parents of those children. Many authors have pointed out that a fractured permanent tooth is a tragic experience for both child and parents, who are more concerned with the aesthetic rather than the symptomatic aspects of the problem (5–7).

Studies that were performed by researchers from different countries show that the prevalence of these injuries ranges from 6 to 37% (1, 2, 8–14). The most common etiologic reasons are falls, automobile-bicycle accidents, collisions and sporting activities (4, 7, 9, 13–23).

Costs to the injured person and the community, arising from such injuries are substantial and understanding the factors that predispose a tooth to fracture is essential in developing a concept of prevention. For these reasons, retrospective studies are important in evaluation of occurrence of this condition and various etiologic factors in relation to the types and patterns of the tooth fracture and those studies can also facilitate the planning of preventive measures. Besides this, dentists can make a better assessment and carry out treatment more effectively with knowledge of potential prognoses of various treatment modalities.

This study was carried out in order to investigate the incidence, etiologic factors and results of dental trauma and the effects of age and gender on the trauma, in the children referred to the Süleyman Demirel University, School of Dentistry, Department of Pedodontics, with the complaint of traumatic injuries of their permanent incisors, from southern cities of Turkey (Isparta, Antalya, Burdur).

Material and methods

The study population consisted of 514 traumatized permanent incisors in 317 patients (114 girls and 203 boys), aged between 6 and 17 years, who has applied to our department with the complaint of pain and/or aesthetic problem because of trauma, during 3 years (December 1, 1999 to December 1, 2002). A clinical examination was performed by two dentists and indicated dental radiographs were obtained for each patient. The information about age, gender, time and cause of the injury, number of tooth affected, the root maturation level and vitality of the affected teeth, condition of supporting tissues, distribution according to the dental arch (maxilla/mandibula) and related information was recorded on the standardized trauma forms. Type of trauma was recorded according to standard Ellis' classification (24). Treatments of the injured teeth were performed by two dentists.

The data were subsequently processed and analyzed using the SPSS Statistical software program (10.0 standard versions). Chi-square test was employed to compare qualitative data and determine the statistical significance. The level of statistical significance was set at $P < 0.05$.

Results

During the 3-year period, 317 children with 514 traumatized permanent incisors were examined and treated. The age of these patients ranged from 6 to 17 years with an average age of 11.31 years (2.36 years, SD).

It was observed that male patients experienced more traumatic dental injury than female patients (64%), but the difference was not statistically significant ($P = 0.209$). The 9–11-year-old group had the highest incidence of traumatic injuries (49.5%) (Table 1). The distribution of age groups and gender according to age of trauma and age of seeking dental care is shown in Fig. 1.

Ellis class II crown fracture was the most frequently seen type of injury (43.8%). It was followed by Ellis class VII (16.5%) and class III (15%) type of fractures (Fig. 2). There was significant difference between type and cause of injury ($P = 0.007$). The relation between age and type of injury was found to be highly statistically significant ($P = 0.0001$), while no statistical significance was found between gender and type of injury ($P = 0.081$).

Table 1. Distribution of type of injury according to age groups

	6–8 years age group [N (%)]	9–11 years age group [N (%)]	12–14 years age group [N (%)]	15–17 years age group [N (%)]	Total [N (%)]
Ellis					
I	18 (3.5)	34 (6.6)	10 (2.0)	4 (0.8)	66 (12.8)
II	48 (9.3)	113 (22.0)	49 (9.5)	15 (3.0)	225 (43.8)
III	11 (2.1)	39 (7.6)	22 (4.3)	5 (1.0)	77 (15.0)
IV	1 (0.2)	–	4 (0.8)	–	5 (1.0)
V	5 (1.0)	15 (3.0)	11 (2.1)	1 (0.2)	32 (6.2)
VI	2 (0.4)	2 (0.4)	5 (1.0)	4 (0.8)	13 (2.5)
VII	37 (7.2)	25 (4.9)	15 (3.0)	8 (1.6)	85 (16.5)
VIII	–	2 (0.4)	1 (0.2)	–	3 (0.6)
Cracked teeth	1 (0.2)	2 (0.4)	1 (0.2)	4 (0.8)	8 (1.6)
Total	123 (24)	232 (45)	118 (23)	41 (8)	514 (100)

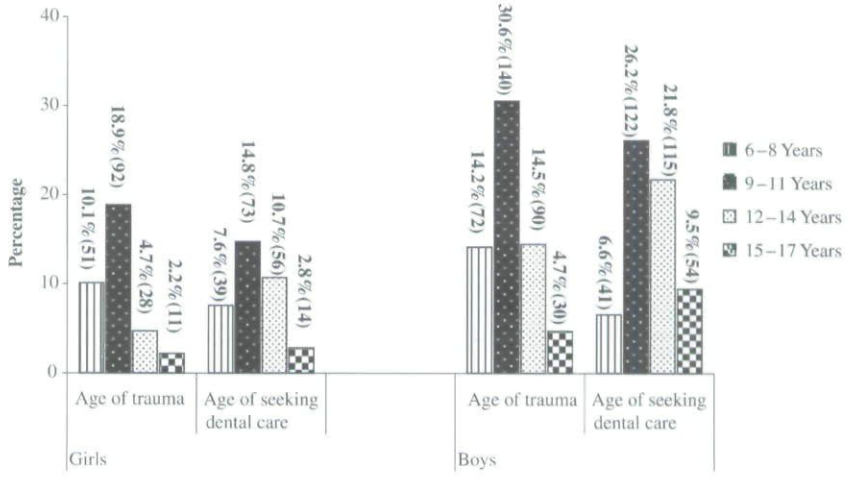

Fig. 1. Distribution of age groups and gender according to age of trauma and age of seeking dental care.

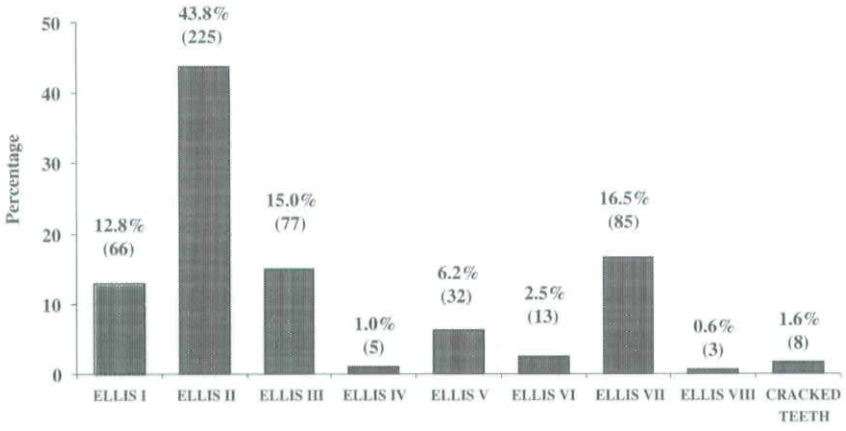

Fig. 2. Distribution of traumatic injuries according to type.

In all age groups, the most frequent cause of injury was found to be unspecified falls (47.6%). Statistically significant difference between age and cause of injury was found at significance level of $P = 0.005$, but there was no statistical significance between gender and cause of injury ($P = 0.233$). Maxillary teeth (88.5%) and central incisors (87.5%) were the most affected teeth from dental trauma.

It was tragic that the percentage of the patients who applied to a dental clinic in the first 3 days after the trauma occurred (22.8%) was less than the percentage of the patients who applied after 3 months and more time period (45.1%) and 4.7% of the children were not aware of the trauma and their injured teeth. Etiology of traumatic injuries by gender and distribution of patients according to application time is given in Table 2.

The number of injured teeth per child was 1.62 and 46.7% of the patients were found to have more than one injured teeth. Approximately, 53.3% of patients presented with one affected tooth, 37% with two and 9.7% with three or more affected teeth (Fig. 3).

Table 2. Etiology of traumatic injuries by gender and distribution of 317 patients by the time of patients' seeking dental care after trauma occurred

Cause of trauma	Boy [N (%)]	Girl [N (%)]	Total [N (%)]
Falls	104 (32.8)	47 (14.8)	151 (47.6)
Collisions	46 (14.5)	29 (9.2)	75 (23.7)
Bicycle accidents	30 (9.5)	25 (7.9)	55 (17.4)
Sport accidents	8 (2.5)	5 (1.3)	12 (3.8)
Traffic accidents	9 (2.8)	2 (0.6)	11 (3.4)
Unknown	4 (1.3)	3 (0.9)	7 (2.2)
Other (while eating etc.)	2 (0.6)	4 (1.3)	6 (1.9)
Time of application after trauma			
Same day	15 (4.7)	11 (3.5)	26 (8.2)
1 day later	21 (6.6)	15 (4.8)	36 (11.4)
2 days later	7 (2.3)	3 (0.9)	10 (3.2)
3 days later	9 (2.8)	4 (1.3)	13 (4.1)
1 week later	14 (4.4)	3 (0.9)	17 (5.3)
1 week to 1 month	22 (6.9)	14 (4.5)	36 (11.4)
1 month to 3 months	12 (3.8)	9 (2.8)	21 (6.6)
3 months to 6 months	14 (4.4)	6 (1.9)	20 (6.3)
6 months and longer	80 (25.2)	43 (13.6)	123 (38.8)
Not aware of the trauma	9 (2.8)	6 (1.9)	15 (4.7)

It was found that 70.2% of the traumatized teeth had complete root formation with a closed apex and 11.3% had the apices just about to be complete according to Nolla's tooth formation classification (25) (Table 3).

Half of the traumatized teeth were observed to give positive response to the pulp tests after trauma, while 13% were observed to give negative response in the first visit and begin to maintain their vitality in the successive evaluations. In contrast, positive response was obtained from 5.1% and those teeth were observed to give negative response in the successive visits (Table 3).

The most common soft tissue injuries were lacerations of lips, chin and buccal mucosa. Seventy-two of 514 traumatized teeth were observed to have soft tissue injuries. Mobility of the injured teeth was evaluated by means of a mobility test, based on a scale of 0–3 (grade 0: no abnormal mobility; grade 1: abnormal horizontal mobility of not more than 1 mm; grade 2: abnormal horizontal mobility of more than 1 mm; grade 3: abnormal horizontal mobility of not more than 1 mm and axial mobility) (26) and 153 teeth (29.8%) were observed to be mobile at 1–3 grades. Splinting was performed for 97 of 153 teeth and those teeth were mobile at second and third grades. There was no need for splinting for the remaining 56 teeth, which were intruded mobile teeth, the teeth, which were mobile at first grade and/or the teeth, which did not complete their eruption at the time of trauma.

There was no need for splinting of the traumatized teeth in the majority of the patients (77.2%) (Table 3). Antibiotics were prescribed only for 91 traumatized teeth (17.7%) and Amoxicillin was the most often prescribed group of antibiotics.

Treatments performed in all patients are classified in Table 4. Twenty of 32 avused teeth could not be reimplanted, since the patients have lost the teeth. Extraction was performed for only six teeth (1%) of

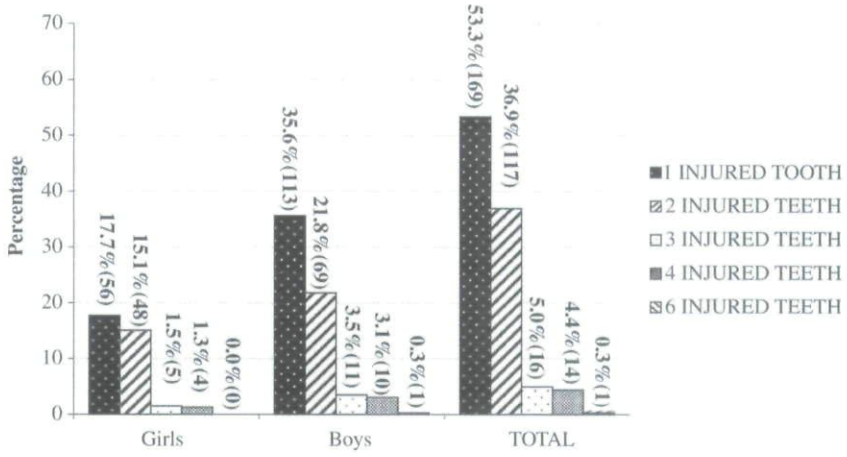

Fig. 3. Distribution of patients according to number of injured teeth.

Table 3. Distribution of 514 injured teeth according to root formation level, response to the pulp tests and splinting periods

	N (%)
Root formation level	
1/3 root formation	31 (6.0)
2/3 root formation	44 (8.6)
Just about to be complete	58 (11.3)
Completed root formation	361 (70.2)
Avulsed teeth (lost)	20 (3.9)
Response to the pulp tests	
First visit (+)	257 (50.0)
Other visits (+)	
First visit (+)	26 (5.1)
Other visits (−)	
First visit (−)	67 (13.0)
Other visits (+)	
First visit (−)	144 (28.0)
Other visits (−)	
Avulsed teeth (lost)	20 (3.9)
Splinting periods	
No need for splint	397 (77.2)
1 week	6 (1.2)
2 weeks	14 (2.7)
3 weeks	6 (1.2)
1 month	30 (5.8)
2 months	17 (3.3)
3 months and more	24 (4.7)
Avulsed teeth (lost)	20 (3.9)

which, one with multiple root fractures, two with large periapical lesions and recurrent periapical enflamation, two with root resorptions caused by late reimplantation and one with indication of orthodontic extraction. There were 34 teeth (7%), which were treated, but could not be controlled, because of the patients' and parents' lack of interest (Fig. 4).

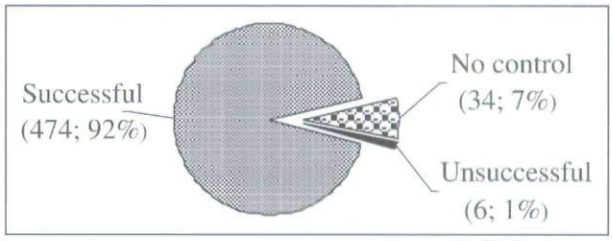

Fig. 4. Success in treatments provided (number of teeth and percentages are given in parenthesis).

Discussion

From an epidemiological point of view, the results of this study confirm the data in the literature. There were 203 boys and 114 girls in the study population. More boys (78%) than girls reported to the clinics with dental injuries. A male predominance because of dental trauma has been reported in the majority of the previous studies (1–3, 5, 10, 13–16, 20–23, 27–33). This might be related to their tendency of being more energetic and choosing more active and vigorous games than girls.

In the present study, most affected age group was 9–11-year-old group and this was in agreement with some studies (29, 31, 34, 35), but in disagreement with the findings of others (2, 3), which have reported the peak age as 8 years.

Our finding that falls were the most frequent cause of trauma in all age groups is generally supported by other studies (3, 13, 14, 16–23). Maxillary central incisors were the most affected teeth from dental trauma, because of their protrusive and vulnerable positions. This finding corroborates the earlier findings of the researchers (2, 3, 14, 16, 19–22, 27, 28, 30, 31).

The most frequent injuries were Ellis class II crown fractures, which are in agreement with some of the previous studies (3, 10, 14, 31). However, there are studies showing that Ellis class I crown fracture is the most common type of injury in permanent dentition (13, 23, 34). Variation in sampling and diagnostic criteria between different studies may explain differences in findings. Patients with Ellis class I crown fracture generally do not have a need for seeking dental care, because they do

Table 4. Treatments provided

Treatment	N (%)
Acid-etch composite restorations (permanent comp. rest., reattachment of fractured piece etc.)	236 (41.3)
Pulp therapy (partial/cervical/cvek pulpatomy, pulpectomy, reatreatment, apexification)	171 (29.9)
Re-implantation	12 (2.1)
Splinting	97 (17.0)
Exam and control	26 (4.5)
Prosthetic replacement and space maintainer	20 (3.5)
Extraction	6 (1.0)
Other (Periodontal surgery, orthodontic treatment etc.)	4 (0.7)

not have any complaint or sometimes they are not aware of their injured teeth. For this reason, the percentage of Ellis class I crown fracture might be higher in this study.

Sea-Lim (2) reported that 45% of injuries to the dentition had concurrent soft-tissue injuries and Al-Jundi (3) reported this value as 16.9%. In the present study, it was found to be low (14%), when compared with those studies. This is probably because the trauma patients have a tendency for attending to dental clinics after a time passed over the trauma and in this period injuries of soft-tissues heal easily in children, who has more rapid epithelial turn-over and tissue regeneration.

Majority of the patients presented with only one affected tooth (53.3%) and the number of injured teeth per patient was 1.62 in this study. This rate has been reported to vary from 1.1 to 1.97 in previous reports (1, 14, 20–22).

There are few published data about the period elapsed between trauma and time of seeking dental care in the literature. In the present study, the percentage of patients attended for treatment in the same day or the day after trauma occurred (19.6%) was very low when compared with other studies (32, 33), in which this percentage was reported as 77 and 68%, respectively. This is another indicator that in our society patients and parents do not give importance to traumatic dental injuries and have a tendency of attending after a time elapsed or waiting until they had acute symptoms of inflammation and/or aesthetic problems.

Among the all study population, the percentage of patients with more than one trauma history was 5.05%. Appropriate treatment options should be preferred for the hipermobile patients with multiple trauma history and the parents should be warned against a probable secondary trauma case. The damage caused by trauma on the hard and soft tissues of mouth can be minimized with accuracy in diagnosis and treatments performed without loosing time. It can be concluded that careful diagnosis and periodic check-ups are necessary in trauma cases.

The results of this study reveals that a preventive educational program should be instituted in Turkey, which is directed at parents and school teachers, in order to inform them about what they should do in dental trauma cases and the importance of immediate attendance for dental care. Bicycle accidents were 17.4% of injury sources. Preventive measures have great importance in these cases. Mandatory use of mouthguards and preventive helmets with bicycles and motorcycles can be useful in reducing the number of traumatic injuries in children. In addition, both parents and patients should be educated about necessity and benefits of mouthguards and helmets.

References

1. Wilson S, Smith GA, Preisch J, Casamassimo PS. Epidemiology of dental trauma treated in an urban emergency department. Pediatr Emerg Care 1997;3:12–5.
2. Sea-lim V, Hon T, Wing HYK. Traumatic dental injuries at the accident and emergency department of Singapore general hospital. Endod Dent Traumatol 1995;11:32–6.
3. Al-Jundi SH. Dental emergencies presenting to a dental teaching hospital due to complications from traumatic dental injuries. Dent Traumatol 2002;18:181–5.
4. Gutmann JL, Gutmann MSE. Cause, incidence and prevention of trauma to teeth. Dent Clin North Am 1995;39:1–11.
5. Maiwald HT. Therapy for fractured crown of juvenile permanent teeth. Dtsch Stomatol 1990;40:426–7.
6. Garcia-Godoy F. Reason for seeking treatment after traumatic dental injuries. Endod Dent Traumatol 1989;5:180–1.
7. Garcia-Godoy F. Reasons for traumatic injuries to teeth in Swedish children living in an urban area. Swed Dent J 1990;14:115–22.
8. Schatz JP, Joho JP. A retrospective study of dento-alveolar injuries. Endod Dent Traumatol 1994;10:11–4.
9. Marcenes W, Al Beiruti N, Tayfour D, Issa S. Epidemiology of traumatic injuries to the permanent incisors of 9–12-year-old school children in Damascus, Syria. Endod Dent Traumatol 1999;15:117–23.
10. Borssen E, Holm AK. Traumatic dental injuries in a cohort of 16-year-olds in northern Sweden. Endod Dent Traumatol 1997;13:12–5.
11. Lalloo R. Risk factors for major injuries to the face and teeth. Dent Traumatol 2003;19:12–4.
12. Zerman N, Cavalleri G. Traumatic injuries to permanent incisors. Endod Dent Traumatol 1993;9:61–4.
13. Traebert J, Peres MA, Blank V, Böell RS, Pietruza JA. Prevalence of traumatic dental injury and associated factors among 12-year-old school children in Florianopolis, Brazil. Dent Traumatol 2003;19:15–8.
14. Rajab LD. Traumatic dental injuries in children presenting for treatment at the Department of Pediatric Dentistry, University of Jordan, 1997-2000. Dent Traumatol 2003;19:6–11.
15. Marcenes W, Alessi ON, Traebert J. Causes and prevalence of traumatic injuries to the permanent incisors of school children aged 12 years in Jaragua do Sul, Brazil. Int Dent J 2000;50:87–92.
16. Viada S, Rivera N, Nava S, Hernandez N, Moron A, Contreras J. Temporary and permanent restorations for fractured permanent teeth with immature apices: a clinical study. J Dent Child 1997;Nov-Dec:114–6.

17. Fried I, Erickson P, Schwartz S, Keenan K. Subluxation injuries of maxillary primary anterior teeth: epidemiology and prognosis of 207 traumatized teeth. Pediatr Dent 1996;18:145–51.
18. Osuji OO. Traumatized primary teeth in Nigerian children attending university hospital: the consequences of delays in seeking treatment. Int Dent J 1996;46:165–70.
19. Andreasen FM, Dungaard JJ. Treatment of traumatic dental injuries in children. Tandlaegernes Tidsskr 1992;March:76–89.
20. Lombardi SS, Sheller B, Williams BJ. Diagnosis and treatment of dental trauma in a children's hospital. Pediatr Dent 1998;20:112–20.
21. Altay N, Güngör HC. A retrospective study of dento-alveolar injuries of children in Ankara, Turkey. Dent Traumatol 2001;17:201–4.
22. Şaroğlu I, Sönmez H. The prevalence of traumatic injuries treated in the pedodontic clinic of Ankara University, Turkey, during 18 months. Dent Traumatol 2002;18:299–303.
23. Kargul B, Çağlar E, Tanboğa I. Dental trauma in Turkish children, İstanbul. Dent Traumatol 2003;19:72–5.
24. Ellis RG, Davey KW. The classification and treatment of injuries to the teeth of children, 5th edn. Chicago: Yearbook Medical Publishers; 1970.
25. Nolla CM. The development of permanent teeth. J Dent Child 1960;27:254–66.
26. Andreasen JO, Paulsen HU, Yu Z, Ahlquist R, Bayer T, Schwartz O. A long term study of 370 autotransplanted premolars. Part I. Surgical procedures and standardized techniques for monitoring healing. Eur J Orthodon 1990;12:3–13.
27. Bastone EB, Freer TJ, Mc Namara JR. Epidemiology of dental trauma: A review of the literature. Aust Dent J 2000;45:2–9.
28. Hamdan MA, Rock WP. A study comparing the prevalence and distribution of traumatic dental injuries among 10–12 year-old children in an urban and in a rural area of Jordan. Int J Pediatr Dent 1995;5:237–41.
29. Brown CJ. The management of traumatically intruded permanent incisors in children. Pediatr Dent 2002;39:38–44.
30. Darendeliler-Kaba A, Paschoud Y, Darendeliler MA, Marechaux S. Teenage luxation injury: report of case. J Dent Child 1992;59:277–81.
31. Camp J. Diagnosis and management of sports-related injuries to the teeth. Dent Clin North Am 1991;35:733–56.
32. Josefsson E, Karlander EL. Traumatic injuries to permanent teeth among Swedish schoolchildren living in a rural area. Swed Dent J 1994;18:87–94.
33. Gabris K, Tarjan I, Rozsa N. Dental trauma in children presenting for treatment at the Department of Dentistry for Children and Orthodontics, Budapest, 1985–1999. Dent Traumatol 2001;17:103–8.
34. Sanches AV, Garcia-Godoy F. Traumatic dental injuries in 3-to-13-year-old boys in Moterrey, Mexico. Endod Dent Traumatol 1990;6:63–5.
35. Jarvinen S. Fractured and avulsed permanent incisors in Finnish children. Acta Odontol Scand 1979;37:47–50.