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The relationship between sports activities and permanent incisor crown fractures in a group of school children aged 7–9 and 11–13 in Ankara, Turkey

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Abstract – The objective of the study was to determine the distribution, aetiology of the crown fractures of permanent anterior teeth in children aged 7–9 and 11–13 years and to identify the role of participation in sports associated with crown fractures. The study population comprised 2570 students from 10 primary schools randomly selected from five municipalities in Ankara, Turkey. Two paediatric dentists examined all permanent maxillary and mandibular incisors for evidence of fracture and completed a standardized examination form to obtain information on the age, gender, severity of incisor injury and frequency and type of sports participation for each child, as well as whether or not children used mouthguards during sports activities. Chi-square and z-tests were used to determine differences. A total of 191 (7.43%) of the 2570 subjects examined were affected by dental trauma. The proportion of fractured incisors was significantly higher in males than in females among older children ($P < 0.01$). Out of a total of 222 fractured teeth, 84% involved the maxillary central incisors. Bicycling caused significantly higher rates of crown fractures than other types of sports ($P < 0.05$). The percentage of incisal fractures caused by sports-related accidents was 14.14%. The number of children interested in sports is high, and the sports chosen are generally contact sports. The high rate (14.14%) of crown injuries caused by sports activities supports these findings.

Incisor teeth play a critical role in aesthetics, phonetics, and functional activities. Unfortunately, the morphology and location of these teeth make them susceptible to a range of traumatic injuries (1–3). Trauma to the teeth may result in emotional distress for both parents and affected children. In addition to pain and possible infection, the consequences of incisal trauma include alteration in physical appearance, speech defects and psychological impacts, thus affecting the child's quality of life (4).

The prevalence of incisor injury has been reported to range from 1.8% to 49%. The great variation in reported prevalence has been related to different factors such as the type of the study, trauma classification, limited age groups, geographical and behavioral differences between study locations and countries (5–18).

The leading causes of most dental trauma are accidental falls and violence. Other causes include traffic accidents and collisions with people and objects. In addition, as children become involved in sports at younger and younger ages, failure to wear a properly fitted mouthguard while engaging in sports activities has become another significant factor in increasing the risk of dental trauma (19–25). Reports indicate that between nine and 39% of all dental injuries are sports-related, with males sustaining injuries at two or three times the rate of females and with children aged 8–15 years among the majority of patients (19, 20, 22–24, 26).

Some authors (8) reported home as the most common location of traumatic dental injuries, whereas others (27) reported the school as the location for multiple dental injuries. Bhat and Li (28) stated that home was the predominant location of injuries for children under 5 years of age, whereas for children aged 5–14 years, the major location of injuries was outside the home.

The objective of the study was to determine the distribution, aetiology of the crown fractures of permanent anterior teeth in children aged 7–9 and 11–13 years and to identify the role of participation in sports associated with crown fractures.

Material and methods

The subjects of this study consisted of 2570 second- and fifth-grade students from 10 public primary schools randomly selected from five municipalities in Ankara, Turkey. A complete list of schools and formal approval were obtained from the Ministry of Education.

Examinations were performed by two pediatric dentists during the 2005 and 2006 academic years. Examinations were conducted in the classroom, with the student standing in front of the seated examiner. Each examiner used a millimeter ruler, gloves and tongue depressor for cheek retraction.

Information regarding dental trauma were recorded using a trauma data form designed especially for this study. The study was based on self-reports of the children. In addition to personal information, the form collected data about frequency of sports participation, utilization of mouthguards, causes of the injuries and places where they occurred, numbers and types of fractured incisors and types of crown fractures. A crown was considered fractured when a part of its surface was missing as a result of trauma and there was no evidence of caries. All maxillary and mandibular anterior teeth were examined for evidence of fracture and injuries were classified according to Sweet (29) as either: (i) enamel injury only; (ii) enamel and dentin injury, without pulpal involvement; (iii) injury with pulpal exposure; or (iv) fracture at or below the gingival margin. As radiographic examinations could not be conducted within the framework of this study, injuries that involved root or alveolar bone only were not assessed. Although other evidences of trauma such as tooth discoloration and luxation were not investigated, increased over-jet and inadequate lip coverage were examined because of their perceived association with incisor trauma. Over-jet was measured from the buccal surface of the most protrusive mandibular incisor to the buccal surface of the most protrusive maxillary central incisor using a millimeter ruler. Presence/absence of both primary and permanent teeth in the oral cavity was also recorded. Chi-squared and *z*-tests were used to determine differences, with a level of 0.05 considered significant.

Results

All second-and fifth-grade students present at school on the days the examinations were conducted were asked to participate and all of them agreed (100% response rate). Of the 2570 children examined, 1300 were girls and 1270 were boys. Slightly more than half were in the 11–13 year age group [n = 1429 (734 girls, 695 boys)] and the remainder were in the 7–9 age group [n = 1141 (566 girls, 575 boys)].

The overall rate of incisal fractures was found to be 7.43%. Older children accounted for a higher percentage of the total (78.53%) than younger children (21.47%) ($P < 0.01$). Incisal crown fractures were found in a total of 191 children, 150 (62 girls, 88 boys) in the 11–13 age group and 41(23 girls, 18 boys) in the 7–9 age group. In the older age group, boys had significantly higher fracture rates than girls ($P < 0.01$); however, in the younger age group, there was no significant difference in fracture rates between the genders ($P > 0.05$).

Figure 1 shows the distribution of fractures among incisors. Central maxillary teeth accounted for the majority (84%) of incisors affected by trauma ($P < 0.01$). There was no significant difference in fracture rates between the left and right side of the mouth. Among children with traumatized teeth, 161 children (84.29%) had one fractured tooth, 29 children (15.18%) had two fractured teeth and one child (0.53%) had three fractured teeth. In total, 222 fractured teeth were found in the study population. Of these, 120 (54.1%) were enamel fractures and 102 (45.9%) were dentin fractures. No fractures were found with pulpal exposure or below the gingival margin.

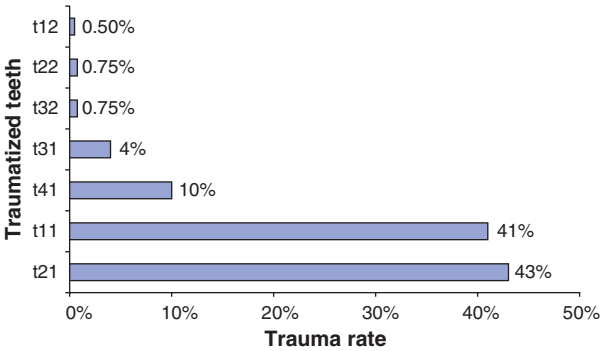

Fig. 1. The distribution of the traumatized teeth.

The study found no correlations between incisor trauma and age, gender or place the traumatic incident occurred ($P > 0.05$). Of the 191 children with fractured incisors, 32 (16.75%) said the trauma had occurred while they were at school, 45 (23.56%) said the trauma had occurred at home, 77 (40.31%) said the trauma occurred at some other place (neither home nor school) and 37 (19.43%) said they could not remember where the traumatic incident occurred.

Children were also asked to describe how the trauma occurred. Their answers showed the primary causes to be collisions with people/objects (39.79%), accidental falls (26.18%) and sport accidents (14.14%). The remaining could not remember how the traumatic accident occurred.

Inadequate lip coverage was not found to be associated with incisor injury ($P > 0.05$); however, increased over-jet was found to be associated with incisor injury ($P < 0.01$). Among the study population, 49 children (1.91%) had an over-jet greater than 5 mm. 14 students with an over-jet greater than 5 mm had one or more fractured incisors.

The distribution of anterior crown fractures in relation to the sport practiced is given in Table 1. Bicycling caused significantly higher rates of crown fractures than other types of sports ($P < 0.05$).

A majority of children (n = 1693; 65.91%) were found to take part in sports activities only once a week during physical education classes. Boys were found to take part in sports significantly more often than girls ($P < 0.05$). The distribution of anterior crown fractures in relation to the frequency of sports participation is given in Table 2. Children who practiced sports once a week had significantly lower fracture rates than those associated with sports activities 1–3 and 4–6 days a week ($P < 0.05$); however there was no statistical difference between 1–3 and 4–6 days of sports participation ($P > 0.05$). None of

Table 1. Distribution of anterior crown fractures in relation to the sport practised

Type of sport	Participants (*n*)	Students with crown fractures due to sports (*n*)
Physical education classes	1693	7
Soccer	441	7
Volleyball	110	2
Basketball	144	3
Bicycling*	109	7
Martial arts	18	0
Others	55	1
Total	2570	27

*$P < 0.05$.

Table 2. Distribution of anterior crown fractures in relation to the frequency of sports participation

Frequency of sports participation	Participants (*n*)	Students with crown fractures due to sports (*n*)
1 day*	1693	7
1–3 days	733	14
4–6 days	132	6
7 days	11	0
Total	2570	27

*$P < 0.05$.

the children in this study used mouthguards during sport activities.

Discussion

As the prevalence of dental caries has decreased, awareness and concern of other child-related oral health issues have arisen among dental public health professionals with dental trauma achieving more of the attention it deserves (12). This study assessed the frequency, types, causes and place of occurrence of incisor crown fractures as well as the rates of sports participation among school children ages 7–9 and 11–13 years in Ankara, Turkey. It should be noted that because the study relied solely on self-reports of the children, data about the cause and place of trauma could be inaccurate.

Epidemiological surveys have reported vastly different rates of dental trauma (5–17). These surveys have used different criteria in determining the occurrence of dental trauma and have focused on different age groups. This study found an incisor trauma rate of 7.43% among a group of school children.

Previous studies have reported a relationship between dental trauma and sports activity, with rates ranging anywhere from 9% to 39% (17–26, 30). This study found 14.14% of incisor fractures in school children to be a result of sports activity. Regular use of an athletic mouthguard is the main method to prevent intra-oral trauma during sports activities (31–35). However, extensive health education is needed to raise public awareness to increase the use of mouthguards among children (36). None of the children in this study used mouthguards. This finding was similar to that of the previous studies in Turkey (37–40).

Even though the school environment did not account for any greater rates of traumatic dental injury than any other environments, schools play an important role in shaping children's physical behavior (12), making teachers important agents in public health.

Numerous studies have reported that dental injuries occur more frequently among men than among women (5–7, 17, 18, 21, 30, 41–50). Considering that men, compared with women, are perceived to participate in more strenuous activities, such as contact sports and aggressive games that involve higher risks of trauma, this is not surprising. On the other hand, some studies have reported no difference in injury rates between the genders (8, 15, 16, 51). Baghdady et al. (52) reported that among children under nine years of age, girls had higher injury rates than boys, but that among older children, boys had higher rates than girls. This study found boys had statistically higher rates of traumatic dental injury than girls among in the older age group ($P < 0.01$), but found statistically no difference between boys and girls in the younger age group ($P > 0.05$).

As with other studies, this study found higher fracture rates for maxillary central incisors when compared with other incisors (6–8, 10, 15, 17, 18, 41, 42, 45, 46, 49–53). This finding can be expected, considering that the maxillary central incisors usually erupt earlier than the maxillary lateral incisors and are thus at longer risk (3). It has also been suggested that maxillary incisors are more frequently injured than mandibular incisors because the non-rigid connection between the lower jaw and the cranial base lessens any impact to the lower teeth (52).

This study found enamel and enamel/dentin injuries to be the most common types of incisor fractures; however, differences between injury types were not statistically significant ($P > 0.05$). Most of the injuries were also found to be limited to a single tooth. These findings are in agreement with those of numerous earlier studies (3, 6, 8–10, 15–18, 42, 44–47, 54). While hospital-based studies have reported more severe injuries and higher rates of trauma involving two teeth (26, 43), this may be because of the fact that individuals do not seek treatment for less severe injuries.

Previous studies have reported a relationship between incisor trauma and both over-jet (8, 16, 17, 48, 49, 54–56), and lip incompetence (16, 41, 48, 54).This study found increased over-jet to be associated with incisor injury ($P < 0.01$), but found no connection between incisor injury and inadequate lip coverage ($P > 0.05$).

Bicycling caused significantly higher rates of crown fractures than other types of sports ($P < 0.05$). Correlation between crown fractures and frequency of sports participation was relatively weak. Children taking part in sports activities 1–3 and 4–6 days a week had significantly higher crown fracture rates than others participating in sports once a week ($P < 0.05$); but contrary to what one would expect, no crown fractures were found in children participating in sports every day.

Conclusion

Children have been found to have a high interest in sports, particularly contact sports. However, children engaged in such sports have been observed not to wear mouthguards. In this study, a relation was found between crown fractures and type of sport and also a relation between crown fractures and frequency of sports participation.

References

1. Shaw W, Rees G, Dawe M, Charles C. The influence of dentofacial appearance on the social attractiveness of young adults. Am J Orthod 1985;87:21–6.
2. Laine T, Jaroma M, Linnasalo A. Articulatory disorders in speech as related to the position of the incisors. Eur J Orthod 1985;7:260–6.
3. Kania MJ, Keeling SD, McGorray SP, Wheeler TT, King GK. Risk factors associated with incisor injury in elementary school children. Angle Orthod 1996;66:423–32.
4. Alonge OK, Narendran S, Williamson DD. Prevalence of fractured incisal teeth among children in Harris County, Texas. Dent Traumatol 2001;17:218–21.
5. Marcus M. Delinquency and coronal fractures of anterior teeth. J Dent Res 1951;30:513–4.
6. O'Mullane D. Injured permanent incisor teeth: an epidemiologic study. J Irish Dent Assoc 1972;18:160–73.
7. Andreasen J, Ravn J. Epidemiology of traumatic dental injuries to primary and permanent teeth in a Danish population sample. Int J Oral Surg 1972;1:235–9.
8. Garcia-Godoy F, Sanchez R, Sanchez J. Traumatic dental injuries in a sample of Dominican school children. Community Dent Oral Epidemiol 1981;9:193–217.
9. Hardwick J, Newman P. Some observations on the incidence and emergency treatment of fractured permanent anterior teeth of children. J Dent Res 1954;33:730.
10. Garcia-Godoy F, Morban-Laucer F, Corominas L, Franjul R, Noyola M. Traumatic dental injuries in school children from Santo Domingo. Community Dent Oral Epidemiol 1985;13:177–9.
11. Andreasen JO, Andreasen FM, Bakland LK, Flores MT Traumatic dental injuries – a manual, 1st edn. Copenhagen: Munksgaard; 1999. p. 6–7.
12. Sgan-Cohen HD, Megnagi G, Jacobi Y. Dental trauma and its association with anatomic, behavioral and social variables among fifth and sixth grade schoolchildren in Jerusalem. Community Dent Oral Epidemiol 2005;33:174–80.
13. Skaare AB, Jacobsen I. Dental injuries in Norwegians aged 7–18 years. Dent Traumatol 2003;19:67–71.
14. Al-Majed I, Murray JJ, Maguire A. Prevalence of dental trauma in 5–6 and 12–14-year-old boys in Riyadh, Saudi Arabia. Dent Traumatol 2001;17:153–8.
15. Tovo MF, dos Santos PR, Kramer PF, Feldens CA, Sari GT. Prevalence of crown fractures in 8–10 years old children in Canoas, Brazil. Dent Traumatol 2004;20:251–4.
16. Al-Khateeb S, Al-Nimri K, Abu Alhaija E. Factors affecting coronal fracture of anterior teeth in North Jordanian children. Dent Traumatol 2005;21:26–8.
17. Tapias MA, Jimenez-Garcia R, Lamas F, Gil AA. Prevalence of traumatic crown fractures to permanent incisors in a childhood population: Mostoles, Spain. Dent Traumatol 2003;19:119–22.
18. Rajab LD. Traumatic dental injuries in children presenting for treatment at the Department of Pediatric Dentistry, Faculty of Dentistry, University of Jordan, 1997–2000. Dent Traumatol 2003;19:6–11.
19. Gutmann JL, Gutmann MSE. Cause, incidence and prevention of trauma to teeth. Dent Clin North Am 1995;39:1–13.
20. Hayrinen-Immonen R, Sane J, Perkki K, Malmstrom M. A six-year follow-up study of sports-related dental injuries in children and adolescents. Endod Dent Traumatol 1990;6:208–12.
21. Bastone EB, Freer TJ, McNamara JR. Epidemiology of dental trauma: a review of the literature. Aust Dent J 2000;45:2–9.
22. Onyeaso CO. Secondary school athletes: a study of mouthguards. J Natl Med Assoc 2004;96:240–5.
23. McNutt T, Shannon SW, Wright JT, Feinstein RA. Oral trauma in adolescent athletes: a study of mouth protectors. Pediatr Dent 1989;11:209–13.
24. Levin L, Friedlander LD, Geiger SB. Dental and oral trauma and mouthguard use during sport activities in Israel. Dent Traumatol 2003;19:237–42.
25. Andreasen JO, Andreasen FM, Bakland LK, Flores MT Traumatic dental injuries – a manual, 1st edn. Copenhagen: Munksgaard; 1999. p. 48–9.
26. Martin IG, Daly CG, Liew VP. After-hours treatment of anterior dental trauma in Newcastle and western Sydney: a four year study. Aust Dent J 1990;35:27–31.
27. Stockwell AJ. Incidence of dental trauma in the Western Australian School Dental Service. Community Dent Oral Epidemiol 1988;16:294–8.
28. Bhat M, Li SH. Consumer-product-related tooth injuries in hospital emergency rooms: United States, 1979–87. Community Dent Oral Epidemiol 1990;18:133–8.
29. Sweet C. A classification and treatment for traumatized anterior teeth. J Dent Child 1955;22:144–9.
30. Jackson NG, Waterhouse PJ, Maguire A. Factors affecting treatment outcomes following complicated crown fractures managed in primary and secondary care. Dent Traumatol 2006;22:179–85.
31. Johnsen DC, Winters JE. Prevention of intraoral trauma in sports. Dent Clin North Am 1991;35:657–66.
32. Ranalli DN. Sports dentistry and dental traumatology. Dent Traumatol 2002;18:231–6.
33. American Dental Association, Council on Dental Materials. Mouth protectors and sport team dentists. J Am Dent Assoc 1984;109:84–7.
34. Ferrari CH, Medeiros JMF. Dental trauma and level of information: mouthguard use in different contact sports. Dent Traumatol 2002;18:144–7.
35. Muller-Bolla M, Lupi-Pegurier L, Pedeutour P, Bolla M. Orofacial trauma and rugby in France: epidemiological survey. Dent Traumatol 2003;19:183–92.
36. Diab N, Mourino AP. Parental attitudes toward mouthguards. Pediatr Dent 1997;19:455–60.
37. Cetinbas T, Sonmez H. Mouthguard utilization rates during sport activities in Ankara, Turkey. Dent Traumatol 2006;22:127–32.
38. Kececi AD, Eroglu E, Baydar ML. Dental trauma incidence and mouthguard use in elite athletes in Turkey. Dent Traumatol 2005;21:76–9.
39. Kececi AD, Cetin C, Eroglu E, Baydar ML. Do custom-made mouthguards have negative effects on aerobic performance capacity of athletes? Dent Traumatol 2005;21:276–80.
40. Tulunoglu I, Ozbek M. Oral trauma, mouthguard awareness, and use in two contact sports in Turkey. Dent Traumatol 2006;22:242–6.
41. Ravn JJ. Dental injuries in Copenhagen schoolchildren, school years 1967–1972. Community Dent Oral Epidemiol 1974;2:231–45.
42. Gutz D. Fractured permanent incisors in a clinic population. J Dent Child 1971;38:94–121.
43. Liew V, Daly C. Anterior dental trauma treated after-hours in Newcastle, Australia. Community Dent Oral Epidemiol 1986;14:362–6.

44. Kırzıoğlu Z, Ozay SME, Karayılmaz H. Traumatic injuries of permanent incisors in children in southern Turkey: a retrospective study. Dent Traumatol 2005;21:20–5.
45. Saroğlu I, Sonmez H. The prevalence of traumatic injuries treated in the pedodontic clinic of Ankara University, Turkey, during 18 months. Dent Traumatol 2002;18:299–303.
46. Altay N, Gungor HC. A retrospective study of dento-alveolar injuries of children in Ankara, Turkey. Dent Traumatol 2001;17:201–4.
47. Kargul B, Caglar E, Tanboga I. Dental trauma in Turkish children, Istanbul. Dent Traumatol 2003;19:72–5.
48. McEwen J, McHugh W. Fractured maxillary central incisors and incisal relationships. J Dent Res 1967;46:1290.
49. Grimm S, Frazao P, Antunes JLF, Castellanos RA, Narvai PC. Dental injury among Brazilian schoolchildren in the state of Sao Paulo. Dent Traumatol 2004;20:134–8.
50. 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.
51. Garcia-Godoy FM. Prevalence and distribution of traumatic dental injuries to the permanent teeth of Dominican children from private schools. Community Dent Oral Epidemiol 1984;12:136–9.
52. Baghdady V, Ghose L, Enke H. Traumatized anterior teeth in Iraqi and Sudanese children- a comparative study. J Dent Res 1981;60:677–80.
53. Garcia-Godoy FM, Morban-Laucer F, Corominas L, Franjul R, Noyola M. Traumatic dental injuries in preschool children from Santo Domingo. Community Dent Oral Epidemiol 1983;11:127–30.
54. O'Mullane D. Some factors predisposing to injuries of permanent incisors in school children. Br Dent J 1973;134:328–32.
55. Eichenbaum I. A correlation of traumatized anterior teeth to occlusion. J Dent Child 1963;30:229–36.
56. Jarvinen S. Incisal over-jet and traumatic injuries to upper permanent incisors. Acta Odont Scand 1978;36:359–62.