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Epidemiological aspects of dental trauma associated with maxillofacial injures: Ten years of clinical experience in Trieste, Italy

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Abstract

Background/Aims: The prevalence of dental injuries in patients with facial fractures is relevant. Epidemiologically, dental trauma in association with facial fractures generally affects the age group between 20 and 40 years old, with a higher prevalence in males. The aim of this retrospective study was to identify the incidence and etiology of dental trauma associated with facial fractures over a 10-year period.

Methods: From January 2009 to April 2019, among 381 patients with facial fractures, 353 were included in this study. Age, gender, trauma etiology, injured teeth and dental treatment were investigated.

Results: From 353 patients, with a mean age of 49.7 ± 19.9 years, 247 (70%) were males and 106 (30%) were females. Accidental falls were the most common type of injury (n = 118, 33.4%), followed by road accidents (n = 90, 25.5%), assaults (n = 60, 17%) and sports trauma (n = 37, 10.5%). Fifty-five subjects (15.60%) had dental injuries associated with facial fractures. Of the 145 teeth involved, 48 (33.1%) were diagnosed with luxation, 22 teeth (15.2%) were avulsed, 11 teeth (7.5%) suffered a concussion and there were 10 (6.8%) alveolar wall fractures.Uncomplicated enamel-dentin fracture was the more frequent hard tissue injury (n = 21, 14.5%), followed by complicated crown-root fracture (n = 10, 6.9%), infraction (n = 8, 5.5%), enamel fracture (n = 3, 2%) and complicated enamel-dentin fracture (n = 3, 2%). There was a peak in incidence between 21 and 40 years (42%). Males had a significantly higher risk of facial fractures with dental injury (75%). Maxillary incisors and canines (62.8%) were the most affected teeth.

Conclusions: There was a high prevalence of dental injuries associated with facial fractures. Maxillary incisors were the most injured teeth, with a higher prevalence in males.

KEYWORDS
dental trauma, epidemiology, maxillofacial injures, public health

1 | INTRODUCTION

Dental trauma is a significant issue in terms of costs, frequency and age (young patients) in oral public health.[1] The treatment process is often the result of a collaboration between different specialists such as oral surgeons, maxillofacial surgeons, endodontists, orthodontists, pediatric dentists and periodontists.[2]

In literature, dental trauma has been found more frequently in male gender, and it has been associated to low socioeconomic status as far as Class II skeletal patterns.[3] In children and adolescents, subjects with malocclusion and orthodontic needs, as well as those with increased overjet seem to be at higher risk of dental trauma of maxillary incisors.[4,5]Although the importance of facial features in the developing of dental injuries after maxillofacial trauma, also the characteristics of the impact, the strength and direction of the forces released are important variables in the type of the consequent dental trauma.[6]

In maxillofacial traumatology, the association between the different anatomic structures involved in trauma is quite common and ranges from 4% to 41% of facial fractures, from 0.3% to 24% of ocular trauma, and 08% to 26% of dental trauma with perilesional involvement.[7]

In particular, several articles have shown that the prevalence of dental injuries in patients with facial fractures ranges from 13% to 23%.[8–12] In the research of Zhou et al. and Gassner et al. the numbers increase, being 41.8% and 49.9%, respectively. Rarely, there is a total homogeneity in the inclusion criteria such as etiology, incidence and type of dental trauma[9,11]; for example, in the research of Zhou et al. only injuries in the maxillary bones were examined, while in Ruslin et al. edentulous patients, nose fractures and alveolar process fractures were excluded.[8,9] Epidemiologically, dental trauma in association with facial fractures generally affects an age group between 20 and 40 years old, with a higher prevalence of males.[12]

The aim of this study was to retrospectively analyze and evaluate the incidence and associated factors of dental trauma in patients with maxillofacial fractures surgically treated in the Department of Oral and Maxillofacial Surgery and Odontostomatology of the "Ospedale Maggiore" in Trieste (Italy).

2 | METHODS

This study considered 381 patients, aged 17–89 years old, consecutively treated for maxillofacial trauma at the Department of Oral and Maxillofacial Surgery and Odontostomatology of the "Ospedale Maggiore" in Trieste, Italy (Ethical approval Prot. 271_2019/10.01.21). The database incorporated retrospectively collected data from January 2009 to April 2019. Only surgically treated patients were included in this study. Patients from 0 to 16 years old and patients who received no surgical treatment were excluded. A final number of 353 patients (93%) were recruited and 28 patients (7%) were excluded as the information in the medical records was incomplete. Informed written consent was obtained from each patient to use clinical data for the research that was conducted in agreement with the guidelines of the Helsinki Declaration as revised in 1975 and amended in October 2003. All patients signed an informed consent regarding surgery approval.

The patients' data included age, gender, cause of the maxillofacial trauma, site of injured teeth, type of dental trauma, and dental treatment.

The patients were divided into four groups according to their age at the time of the trauma: 17–20, 21–40, 41–65, and over 65 years.

Facial fractures were divided into nine groups (classification adapted and simplified from Gomez Rosello et al.): ocular-malar-zygomatic complex (COMZ), zygomatic bone, orbit, maxillary bone, mandible, condyle, alveolar process, Le Fort (I, II, and III), and nasal bone.[13] All these fractures were registered on the left side, right side, or on both sides. The causes of the trauma were divided into seven different groups: accidental falls, road accidents, assaults, syncopal episodes, work-related injuries, sports injuries, and other causes (domestic accidents, explosions, attempted suicide by precipitation, falls from height, and accidental trauma).

For the classification of dental trauma, the WHO classification was adopted.[14] Dental trauma was classified at first into maxillary and mandibular and then further subdivided into incisors, canines, premolars, and molars. The types of dental injuries were classified into periodontal injury (concussion, lateral luxation, intrusion, extrusion, avulsion and alveolar wall fracture) and hard dental tissue injury (infraction, enamel fracture, uncomplicated enamel-dentin fracture, complicated enamel-dentin fracture, uncomplicated crown-root fracture, complicated crown-root fracture, cervical third root fracture, middle third root fracture, apical third root fracture, and vertical root fracture).

Finally, dental treatments were classified into six groups: extraction, repositioning and splinting, restorative treatment, endodontic-restorative treatment, prosthetic treatment, restorative, and splinting treatment.

The data analysis was performed using R software (R CORE TEAM, 2019) and Excel (Microsoft Excel, 2010).

3 | RESULTS

Of the 353 patients, 247 (70%) were males and 106 (30%) females. At the time of the analysis, the patients' age was between 17 and 89 years (average 49.7 ± 19.9 years). Of these patients, 55 (15.60%) had dental trauma caused by maxillofacial trauma. Of those 55 patients, 41 (75%) were male and 14 (25%) were female, with an average age of approximately 42 years (Table 2).

Most of the patients (23 patients, 42%) with facial fractures were aged 21–40 years (Table 1). Of the total 353 patients, accidental falls were the most common cause of injury (n = 118, 33.4%), followed by road accidents (n = 90, 25.5%), assaults (n = 60, 17%), sports trauma (n = 37, 10.5%), from syncopal episodes (n = 19, 5.4%), and work-related accidents (n = 14, 4%). About 3.4% (n = 14) of the injuries were represented by other causes such as domestic accidents,

explosions, attempted suicide by precipitation, falls from height, and accidental trauma (Table 3). Concerning dental injuries associated with facial fractures, road accidents (n = 23, 42%) were the most common type of injury, followed by accidental falls (n = 16, 29%), and fights (n = 9, 16.40%). The incidence of sports injuries, as the cause of dental injuries associated with maxillofacial trauma, was significantly lower (one case = 2%) when compared with the total of cases analyzed (Table 3).

Of the total of 55 patients with dental trauma, 145 teeth were involved, including an average of 2.6 teeth per patient. The maxilla had the most injured teeth (103, 71%). Site distribution of dental injuries is shown in Tables 3 and 4.

TABLE 1 Distribution according to age.

Age groups	Trauma (%)
17–20	5%
21–40	42%
41–65	24%
>65	29%

TABLE 2 Distribution according to age and gender.

	Maxillofacial fractures (%)	Dental trauma (%)
Age (average)	49.7	42.3
Gender		
Male	247 (70.0)	41 (75.0)
Female	106 (30.0)	14 (25.0)
Total	353 (100.0)	55 (100.0)

TABLE 3 Distribution of mechanisms of injury in cases of facial fractures or dental injuries.

Etiology	Patients with dental trauma (%)	Patients with maxillofacial fractures (%)
Accidental fall	16 (29.0)	118 (33.4)
Road accident	23 (42.0)	90 (25.5)
Seizures and road accidents	1 (2.0)	1 (0.3)
Syncopal episodes	2 (3.2)	19 (5.4)
Sport	1 (2.0)	37 (10.5)
Work	3 (5.4)	14 (4.0)
Violence	9 (16.4)	60 (17.0)
Explosion	0 (0.0)	2 (0.6)
Domestic accident	0 (0.0)	2 (0.6)
Falls from height	0 (0.0)	5 (1.4)
Attempted suicide by precipitation	0 (0.0)	2 (0.6)
Accidental trauma	0 (0.0)	3 (0.7)
Total	55 (100.0)	353 (100.0)

Of the 145 teeth involved, 48 (33.1%) were diagnosed with luxation (n = 30 lateral luxation, 13 extrusive luxations and 5 intrusive luxations), 22 teeth (15.2%) were avulsed, 11 teeth (7.5%) suffered a concussion, while there were 10 (6.8%) alveolar wall fractures.With regard to hard dental tissues, uncomplicated enamel-dentin fracture was the most frequent (n = 21, 14.5%), followed by complicated crown-root fracture (n = 10, 6.9%), infraction (n = 8, 5.5%), enamel fracture (n = 3, 2%), and complicated enamel-dentin fracture (n = 3, 2%). Only one case had an apical third root fracture and another one had a vertical root fracture. No patients had an uncomplicated crown-root fracture, a cervical root fracture, or a middle-third root fracture.

The dental treatment was divided according to the tissues affected and it is summarized in Tables 5 and 6. All complicated crown-root fractured teeth were extracted (100%). Of three teeth with complicated enamel-dentin fractures, two were extracted, while a conservative restoration was performed for the third tooth. Some teeth affected by uncomplicated enamel dentin fractures were splinted,[6] filled,[9] endodontically treated,[1] restored.[1] Only one enamel fracture was restored and splinted. One tooth with an enamel infraction was extracted.

There was only one case of endodontic-conservative therapy involving an uncomplicated dentin-enamel fracture. In this case, crown lengthening surgery was performed during maxillofacial surgery.

One tooth with a concussion was splinted, 11 teeth affected by luxation were extracted, 33 were splinted for about 2–4 weeks, two were restored, and 1 was filled and splinted. The spaces left by the avulsed teeth were treated with prostheses,[6] while all the fractures of the alveolar wall were treated with the extraction of the affected teeth.

4 | DISCUSSION

This study analyzed and assessed the incidence and associated factors of dental trauma in patients with maxillofacial fractures that were surgically treated. Male patients were more affected than female patients with a male-to-female ratio of 2.3:1. Several studies have reported the same findings, as the male population is more likely to engage in activities defined as dangerous, such as dangerous driving, interpersonal violence, and contact sports.[9,15–17]Nonetheless, Ruslin et al. and Roccia et al. found that females had more frequent dental injuries associated with facial fractures than their male counterparts, while Thoren et al., found no significant difference.[3,4,8]In the current study population, the age of most patients was between 21 and 40 years old, similar to the majority of the recent studies that have investigated facial fractures.[8–10,18]

The most frequent cause of dental injury in association with maxillofacial trauma was road traffic accidents (n = 23, 42%) according to several studies.[5,19,20] Furthermore, Subhashraj et al. stated that road traffic accidents are the most frequent cause of dental trauma in the age group between 21 and 40 years.[20] These reports confirm that road accidents provoke a high-intensity impact causing an increased incidence of dental trauma compared to accidents at work or sports

accidents, in which the intensity of the impact is lower.[9,21] It is interesting to note that in many studies when the number of road traffic accidents decreases, assaults and sports trauma as causes of maxillofacial injuries increase.

TABLE 4 Site distribution of dental injury in the maxilla end mandible.

Site	Maxilla (%)	Mandible (%)	Total
Central incisors	50 (34.5)	14 (9.6)	64
Lateral incisors	29 (20.0)	8 (5.5)	37
Canines	12 (8.2)	4 (2.7)	16
First premolars	3 (2.0)	3 (2.0)	6
Second premolars	5 (3.4)	4 (2.7)	9
First molars	4 (2.7)	4 (2.7)	8
Second molars	0 (0)	4 (2.7)	4
Third molars	0 (0)	1 (0.7)	1
Total	103 (71.0)	42 (29.0)	145

In this study, the prevalence of dental injuries in association with facial fractures was 15.6%. Similar prevalences have been reported in the analyses by Roccia et al (13.1%), Thoren et al (16%), Gassner et al (18.9%), and Lieger et al (19.5%).[7,11,12,18]

The prevalence of dental injuries in association with facial fractures in the present analysis was lower than the prevalence found by Iso-Kungas et al. (22.5%) and Ruslin et al. (23.2%).[8,22] The relatively high prevalence of dental injuries in their studies can be explained by a different choice of inclusion criteria. Patients with any surgically treated maxillofacial fracture and edentulous patients were included in the present study, while pediatric populations and patients who had not received surgical treatment were excluded. In the study of Ruslin et al., the authors claimed that for non-surgically treated patients there was a high probability of dental injuries.[8] In the study of Iso-Kungas et al., the pediatric population was included.[22] The authors concluded that dental injuries in association with facial fractures were generally more complicated in children than adults.

TABLE 5 Dental treatment according to the type of hard dental tissue injury.

	Dental treatment							
Hard dental tissue injury	Extraction	Splinting	Restorative	Endodontic-restorative	Prosthetic	Restorative and splinting	Absent	Total
Absent	24	32	0	0	8	0	0	64
Infraction	1	0	0	0	0	0	7	8
Enamel fracture	0	0	0	0	0	1	2	3
Uncomplicated enamel-dentin fracture	0	6	9	1	1	0	4	21
Complicated enamel-dentin fracture	2	0	1	0	0	0	0	3
Uncomplicated crown-root fracture	0	0	0	0	0	0	0	0
Complicated crown-root fracture	10	0	0	0	0	0	0	10
Cervical third root fracture	0	0	0	0	0	0	0	0
Middle-third root fracture	0	0	0	0	0	0	0	0
Apical third root fracture	1	0	0	0	0	0	0	1
Vertical root fracture	1	0	0	0	0	0	0	1
Total	39	38	10	1	9	1	13	111

TABLE 6 Dental treatment according to the type of periodontal injury.

	Dental treatment							
Periodontal injury	Extraction	Splinting	Restorative	Endodontic-restorative	Prosthetic	Restorative and splinting	Absent	Total
Absent	22	0	10	1	1	0	0	34
Concussion	0	1	0	0	0	0	10	11
Luxation	11	33	0	0	2	1	1	48
Avulsion	0	0	0	0	6	0	16	22
Alveolar wall fracture	6	4	0	0	0	0	0	10
Total	39	38	10	1	9	1	27	125

Last but not least, in the study by Lieger et al., only one maxillofacial surgeon was among the authors of the study.[18] The surgeon followed each patient from the primary examination to surgical treatment and follow-up. In the present study, the patients were examined and surgically treated by multiple specialists. This aspect could have affected data collection, as not all specialists focused on the same factors. A total of 145 injured teeth were observed, with an average of 2.6 teeth per patient. Similar findings can be found in the study by Thoren et al. and Roccia et al.[7,12]A higher number of teeth per patient was analyzed in the study by Iso-Kungas et al ($n = 3.2$), Ruslin et al. ($n = 3.55$) and Zhou et al. ($n = 4.68$).[8,9,22] In these studies, a higher absolute number of injured teeth involved in each patient's trauma came from a larger number of included patients.[8,9,22]

The maxilla had the most injured teeth (103, 71%) and maxillary central incisors (50, 34.5%) were the most affected. Many other studies have shown similar findings.[1,2,7–9,12,19,23] This also corresponds with the studies that have analyzed dental trauma only, without the association with facial fractures, where the maxillary anterior segment is the most affected.[1,24] Only the study by Iso-Kungas et al. found a similar number of teeth involved between the mandible and maxilla.[22] According to the literature, maxillary central incisors are the most affected by dental trauma due to the large maxillary overjet and to the protrusion in the sagittal plane.[25,26] It is interesting to note that nine (75%) of the molars involved in this study were in the mandible. The same findings can be found in the study by Zhou et al. The authors deduced that the mandibular molars are weaker than the maxillary counterparts because of a smaller number of roots with a smaller diameter than the maxillary molars. In addition, they are more subject to dental caries that can undermine their strength, as they are the first permanent posterior teeth to erupt in the oral cavity.[9]

When examining the type of dental injuries, periodontal injuries were the most common, and luxation was the most frequent of these (48). Many studies confirm this with a higher number of injuries of the periodontal tissues rather than hard dental tissues.[9–11] In particular, as shown in the study of Zhou et al., lateral luxation was the most frequent injury to the periodontal tissues.[9] Conversely, in the study of Lieger et al. and Thoren et al., a higher number of injuries to the hard dental tissues was detected, where complicated crown fractures were the most common.[12,18]As observed in the study of Da Silvia et al., periodontal injuries were the most frequent dental injury as a result of maxillofacial trauma suffered by the young population, who are more exposed to high-intensity impact accidents (i.e., road traffic accidents), according to the present study.[6] Following the guidelines of Andreasen et al., every tooth that was diagnosed with complicated crown-root fractures was extracted ($N = 10$, 100%).[2]

For the three teeth with complicated enamel-dentin fractures, two were extracted while the third a conservative restoration was performed. Nine teeth (90%) underwent conservative restorations (uncomplicated enamel-dentin fractures).[2] There was only one case of endodontic-conservative therapy involving an uncomplicated enamel-dentin fracture. In this case, crown lengthening surgery was performed during the maxillofacial surgery.

Of the tooth with periodontal injuries, 33 dislocated teeth were splinted for 2–4 weeks, 11 cases were extracted and the remaining two were restored. It is noteworthy that for five avulsed teeth, a removable partial denture was provided. Only one case of avulsion was treated with implant-prosthetic rehabilitation, deferred for 1 year after the date of the maxillofacial trauma. Only one young patient, following the trauma, avulsed the upper left central incisor. It is important to point out that, despite distinguishing between hard dental injuries and periodontal injuries, the sum of the dental injuries can never be the totality of the teeth examined (145) because there have been cases in which the same tooth has suffered damage to both the periodontal tissues and to the hard dental tissues. Consequently, the chosen therapy has to address both situations.

5 | CONCLUSIONS

The present study has shown a significant dental injury rate in association with facial fractures, especially if the cause of the trauma was a high-intensity impact (i.e., road accidents). The maxillary incisors were more often involved in trauma, with a prevalence in males.

Despite the limitations of this study, it is recommended to standardize the primary examination of maxillofacial trauma, paying attention to potential damage to dental tissues. Dental examinations in all patients with facial fractures should be emphasized.

AUTHOR CONTRIBUTIONS

Fulvia Costantinides conceptualized, wrote and revised the article, Matteo Tonizzo and Federica Dotto collected the data and wrote the first version of the manuscript, Massimiliano Lenhardt, Alberto Borella, Mattia Sclabas revised the data and performed the statistical analysis, Roberto Rizzo and Michele Maglione supervised the work and revised critically the final version of the manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors declare that there is no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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REFERENCES

1. Glendor U. Epidemiology of traumatic dental injuries–a 12 years review of the literature. Dent Traumatol. 2008;24:603–11.
2. Andreasen JO, Lauridsen E, Daugaard-Jensen J. Dental traumatology: an orphan in pediatric dentistry? Pediatr Dent. 2009;3:153–63.
3. Eslamipour F, Iranmanesh P, Borzabadi-Farahani A. Cross-sectional study of dental trauma and associated factors among 9- to 14-year-old schoolchildren in Isfahan. Iran Oral Health Prev Dent. 2016;14:451–7.
4. Borzabadi-Farahani A, Borzabadi-Farahani A, Eslamipour F. An investigation into the association between facial profile and maxillary incisor trauma, a clinical non-radiographic study. Dent Traumatol. 2010;26:403–8.
5. Borzabadi-Farahani A, Borzabadi-Farahani A. The association between orthodontic treatment need and maxillary incisor trauma, a retrospective clinical study. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2011;112:e75–80.
6. Sanaei-Rad P, Hajihassani N, Jamshidi D. Management of a complex traumatic dental injury: crown, crown-root, and root fracture. Clin Case Rep. 2020;8:2504–9.
7. Roccia F, Savoini M, Ramieri G, Zavattero E. An analysis of 711 victims of interpersonal violence to the face, Turin, Italy. J Craniomaxillofac Surg. 2016;44:1025–8.
8. Ruslin M, Wolff J, Boffano P, Brand HS, Forouzanfar T. Dental trauma in association with maxillofacial fractures: an epidemiological study. Dent Traumatol. 2015;31:318–23.
9. Zhou HH, Ongodia D, Liu Q, Yang RT, Li ZB. Dental trauma in patients with maxillofacial fractures. Dent Traumatol. 2013;29:285–90.
10. Da Silva AC, Passeri LA, Mazzonetto R, De Moraes M, Moreira RWF. Incidence of dental trauma associated with facial trauma in Brazil: a 1-year evaluation. Dent Traumatol. 2004;20:6–11.
11. Gassner R, Bösch R, Tuli T, Emshoff R. Prevalence of dental trauma in 6000 patients with facial injuries: implications for prevention. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1999;87:27–33.
12. Thorén H, Numminen L, Snäll J, Kormi E, Lindqvist C, Iizuka T, et al. Occurrence and types of dental injuries among patients with maxillofacial fractures. Int J of Oral Maxillofac Surg. 2010;39:774–8.
13. Gómez Roselló E, Quiles Granado AM, Artajona Garcia M, Juanpere Martí S, Laguillo Sala G, Beltrán Mármol B, et al. Facial fractures: classification and highlights for a useful report. Insights Imaging. 2020;11:49.
14. Andreasen JO, Andreasen FM, Andersson L, editors. Textbook and color atlas of traumatic injuries to the teeth. 5th ed. Hoboken: Wiley-Blackwell; 2018.
15. Boffano P, Roccia F, Zavattero E, Dediol E, Uglesic V, Kovacic Z, et al. European maxillofacial trauma (EURMAT) project: a multicenter and prospective study. J Craniomaxillofac Surg. 2015;43:62–70.
16. Bonavolontà P, Orabona GDA, Abbate V, Vaira LA, Faro CL, Petrocelli M, et al. The epidemiological analysis of maxillofacial fractures in Italy: the experience of a single tertiary center with 1720 patients. J Craniomaxillofac Surg. 2017;45:1319–26.
17. Afzelius LE, Rosén C. Facial fractures: a review of 368 cases. Int J of Oral Surg. 1980;9:25–32.
18. Lieger O, Zix J, Kruse A, Iizuka T. Dental injuries in association with facial fractures. J Oral Maxillofac Surg. 2009;67:1680–4.
19. Cavalcanti AL, Bezerra PM, De Oliveira DM, Granville-Garcia AF. Maxillofacial injuries and dental trauma in patients aged 19-80 years, Recife, Brazil. Rev Esp Cir Oral Maxilofac. 2010;32:11–6.
20. Subhashraj K, Nandakumar N, Ravindran C. Review of maxillofacial injuries in Chennai, India: a study of 2748 cases. Br J Oral Maxillof Surg. 2007;45:637–9.
21. Yamada T, Sawaki Y, Tomida S, Tohnai I, Ueda M. Oral injury and mouthguard usage by athletes in Japan. Dent Traumatol. 1998;14:84–7.
22. Iso-Kungas P, Törnwall J, Suominen AL, Lindqvist C, Thorén H. Dental injuries in pediatric patients with facial fractures are frequent and severe. J Oral Maxillofac Surg. 2012;70:396–400.
23. Gupta M, Das D, Soodan K, Singh C. Dental injuries in patients associated with fracture of facial bones. Oral Maxillofac Surg. 2019;23:63–9.
24. Kaste LM, Gift HC, Bhat M, Swango PA. Prevalence of incisor trauma in persons 6 to 50 years of age: United States, 1988–1991. J Dent Res. 1996;75:696–705.
25. Bastone EB, Freer TJ, McNamara JR. Epidemiology of dental trauma: a review of the literature. Aust Dent J. 2000;45:2–9.
26. Oikarinen K. Pathogenesis and mechanism of traumatic injuries to teeth. Dent Traumatol. 1987;3:220–3.

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