ISSN Print: 2394-7489
ISSN Online: 2394-7497
IJADS 2019; 5(3): 96-100

www.oraljournal.com
Received: 19-05-2019
Accepted: 21-06-2019

Esra Oz
Department of Pedodontics, Suleyman Demirel University, Faculty of Dentistry, Isparta, Turkey

Zuhal Kırzıoglu
Department of Pedodontics, Suleyman Demirel University, Faculty of Dentistry, Isparta, Turkey

Correspondence
Esra Oz
Department of Pedodontics, Suleyman Demirel University, Faculty of Dentistry, Isparta, Turkey

Is there a genetic difference in dental trauma of monozygotic and dizygotic twin children?

Esra Oz and Zuhal Kırzıoglu

Abstract
Aims: It was aimed to investigate the prevalence of dental injuries in twins, and to determine whether there was any differences according to monozygotic and dizygotic twin status.
Material and Methods: Patients were classified as dizygotic and monozygotic twins and the dental trauma history of the patients was questioned. The cause, location of the trauma and the traumatized teeth were recorded. The trauma types were determined by the Andreasen Classification.
Results: The study group consisted of 220 twin patients aged 2–17 years. Of the 110 twin pairs, 86 were dizygotic and 24 were monozygotic twins. Twenty patients in the study group experienced a history of dental trauma (9%). Males were exposed to more dental trauma than females ($p<0.05$). The dental trauma occurred mostly due to falling (65%) in the street (40%). The number of patients with only one tooth affected was higher. Dizygotic twins experienced more dental injuries than monozygotic twins but the relationship was not statistically significant ($p>0.05$). 87.5% monozygotic pairs and 82.6% dizygotic pairs were concordant.
Conclusion: Monozygotic and dizygotic twins do not constitute a differentiation in terms of exposure to dental trauma. Environmental factors seem to play a significant role in determining etiological risk factors.

Keywords: Dizygotic, monozygotic, dental trauma, twins, genetics

Introduction
The majority of traumatic dental injuries that cause aesthetic, psychological, behavioral, therapeutic problems by affecting the appearance and speech of patients occur during childhood and adolescence [1]. In these periods, the etiological risk factors for dental injuries may be affected by environmental and genetic factors [2]. Therefore, it is important to understand the relationship between genetic and environmental factors and to know how these factors affect the etiological risk factors.
Twin studies have led researchers to determine how a genetic disease or symptom is affected by environmental factors. Monozygotic twins are identical with each other and dizygotic twins show 50% similar genetic characteristics. Researchers have emphasized that monozygotic twins are of the same gender and share the same genes, and that the differences observed between them are due to environmental factors, whereas differences between dizygotic twins may be related to both environmental and genetic factors [3, 4]. Hence, these researches involve comparisons of similarity or discrepancy between monozygotic and dizygotic twins. If a particular trait is highly related to monozygotic twins and less correlated with dizygotic twins, the genetic contribution to the variation in this trait is affected [3, 5]. In this way, twin studies provide valuable insights and opportunity to researchers for studying the influence of heredity on a particular trait.
Twin studies that establish genetic-environmental interactions are important to demonstrate the effects of genetic factors on dental and periodontal problems, such as tooth morphology, caries, dental anomalies, malocclusion, and periodontal disease [3, 5-8]. Although few studies have been performed on twins, studies are increasing due to the increase in multiple pregnancies from advanced maternal age and the increasing use of assisted reproductive techniques [9]. Nevertheless, it was seen that a study on monozygotic and dizygotic twins have evaluated the factors associated with genetic risk of traumatic dental injuries in children [2].

In the present study, it was aimed to investigate the prevalence of traumatic dental injuries in twin children, and to evaluate whether it was different according to monozygotic and dizygotic twin status.

Material and methods

For this study, relevant approvals were obtained from Suleyman Demirel University Faculty of Medicine Clinical Research Ethics Committee (approval number: 2018/232). The informed consent form was signed to the parents.

The study included twin patients who referred to Deparment of Pedodontics at Suleyman Demirel University for any dental reason. Patients were grouped as monozygotic and dizygotic twin pairs. The dental trauma history of the patients was questioned, and the patients were classified according to their gender, age, and twin status (monozygotic/dizygotic). The cause and location of dental trauma were recorded in the forms. The clinical examination was performed by the same observer with the help of a mirror and a probe. After the clinical and radiographic examinations, the traumatized teeth were recorded and the trauma types were determined by the Andreasen *et al*. [1] Classification. The amount of the overjet of the patients were measured using the probe horizontally. Patients with more than 3 mm of overjet were recorded.

Patients were grouped into two classes to compare concordance in traumatic dental injuries between twin patients. The first group consisted of cases in which both members of the twin pair were traumatized or not (concordance). The second group consisted of patients in whom only one member of the twin pair suffered from dental trauma (non-concordance).

For statistical analysis, SPSS package program (IBM SPSS Inc., Chicago, USA) was used. "Chi-Square Test" was used for statistical analysis. $p<0.05$ was considered statistically significant.

Results

The study group consisted of 220 twin patients aged 2–17 years who were living in the Western Mediterranean Region of Turkey. Of the 110 twin pairs, 86 were dizygotic (26 males, 27 females, 33 opposite sexed) and 24 monozygotic (12 males, 12 females) twin pairs. The mean age of the patients was 7.40 ± 0.20. The distribution of age and mean age of the patients according to gender differences, monozygotic/dizygotic status were shown in Table 1.

Table 1: Distribution of monozygotic / dizygotic twins according to ages

Ages	Monozygotic		Dizygotic			Total
	Male/Male	Female/Female	Male/Male	Female/Female	Male/Female	
2	-	-	-	-	1	1
3	-	2	-	-	1	3
4	3	1	4	7	4	19
5	-	1	2	6	4	13
6	2	1	3	1	4	11
7	1	1	4	1	4	11
8	1	3	3	4	6	17
9	2	1	4	2	2	11
10	1	-	3	2	1	7
11	-	1	1		2	4
12	2	-	1	2	3	8
13	-	-	-	2	1	3
16	-	-	1	-	-	1
17	-	1	-	-	-	1
Total	12	12	26	27	33	110
Mean age ± SD	7.58 ± 0.84	7.42 ± 1.12	7.73 ± 0.56	7.07 ± 0.59	7.27 ± 0.50	7.40 ± 0.20

Twenty patients in the study group experienced a history of dental trauma (9%). The mean age of patients who suffered from trauma was 6.00 ± 0.59 (female; 5.60 ± 1.29; male; 6.13 ± 0.68) (Table 2). Among twenty patients, 27 teeth (11 permanent teeth, 16 primary teeth) were traumatized (mean: 1.4 teeth per patient). One tooth was affected by a traumatic dental injury in 11 of these patients, two teeth were affected in eight of them, and one patient had a soft-tissue injury without dental involvement. The most affected teeth were upper central incisors and the distribution of teeth was shown in Figure 1. Nine of the trauma patients had crown-dentin fractures, one had a crown-pulp fracture, and the others had luxation trauma. Of the 10 patients who had been traumatized between the ages of 3 and 5 years, three had discoloration of the primary incisor teeth and one patient had been exposed to trauma without caries and a dental abscess was present. The dental trauma occurred mostly due to falling (65%) in the street (40%). Seven of the twenty patients with a dental trauma history had overjet with 3-4 mm or more (Table 2).

Table 2: Distribution of monozygotic / dizygotic twins with a history of dental trauma

Patients	Age of trauma	Gender	Twin status	Location	Cause	Fracture type	Overjet
1	9	Male	M (M/M)	School	Collision	Enamel-dentin	3-4 mm
2	6	Female	D (F/F)	Street	Fall	L.Luxation	-
3	9	Male	D (M/M)	School	Fall	Enamel-dentin	3-4 mm
4	8	Male	D (M/M)	Street	Bicycle	Enamel-dentin	3-4 mm
5	5	Male	M (M/M)	Street	Fall	Avulsion	-
6	2	Male	D (M/M)	Home	Fall	Enamel-dentin	-
7	5	Male	D (M/F)	Home	Collision	L.Luxation	-
8	5	Female	D (M/F)	Home	Fall	L.Luxation	-
9	3	Male	D (M/F)	Street	Collision	Complicated crown	-

10	5	Female	D (M/F)	Street	Fall	Avulsion	-
11	8	Male	D (M/M)	Street	Collision	Enamel-dentin	3-4 mm
12	6	Male	D (M/F)	School	Violence	Soft-tissue injury	-
13	8	Male	D (M/M)	School	Fall	Enamel-dentin	5 mm
14	9	Male	D (M/M)	Street	Fall	Enamel-dentin	-
15	2	Female	D (M/F)	Home	Fall	L.Luxation	-
16	5	Male	D (M/M)	Home	Fall	L.Luxation	3-4 mm
17	4	Male	M (M/M)	Home	Fall	Avulsion	-
18	2	Male	D (M/M)	Home	Collision	Intrusion	-
19	10	Female	D (F/F)	Street	Fall	Enamel-dentin	3-4 mm
20	9	Male	D (M/M)	School	Fall	Enamel-dentin	-

M: monozygotic, D:dizygotic, M/M: male/male, F/F: female/female, M/F: male/female

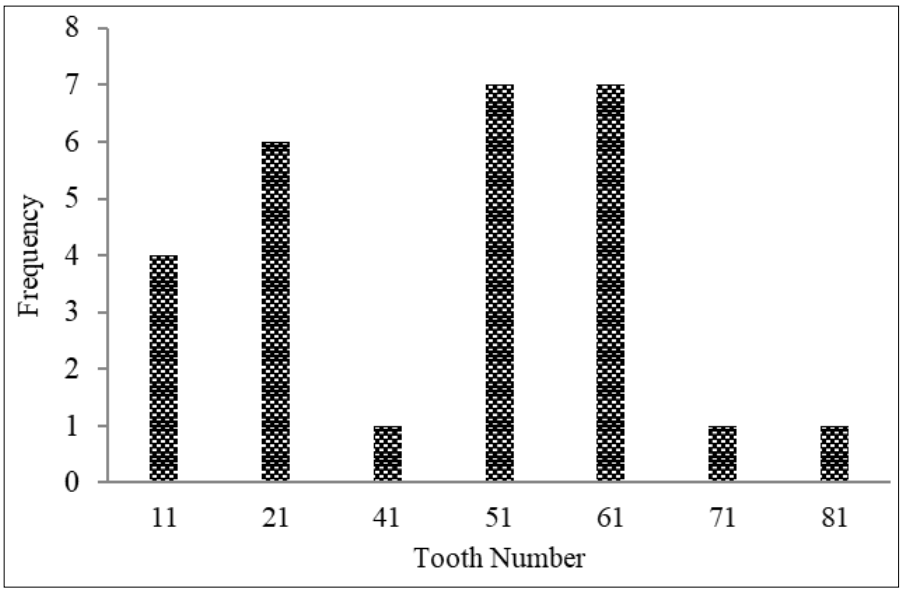

Fig 1: Distribution of traumatic dental injuries according to affected teeth

When evaluated according to gender, it was observed that males were exposed to more trauma than females. The relationship between them was found statistically significant (x^2:5.695; p=0.017). Dizygotic twins experienced more traumatic dental injuries than monozygotic twins. The relationship between twins was not statistically significant (x^2:0.49; p=0.48). Males with a twin brother and a twin sister were exposed to the same proportions of dental trauma (9.1%). Females with a twin brother (three dizygotic twin pairs) suffered from more dental injuries than females with a twin sister (two dizygotic twin pairs). Both members of a dizygotic twin pair of the same sex (male/male) had a history of dental trauma.

An investigation into the concordance of the experienced traumatic dental injuries revealed that 21 (87.5%) of the monozygotic pairs and 71 (82.6%) of the dizygotic pairs were concordant. In general, 93 (84.6%) of the twin pairs were observed concordance. Higher concordance was observed in traumatic injuries within monozygotic twins compared to dizygotic twins. The differences in concordance were not statistically significant (x^2:0.335; p=0.563) (Figure 2).

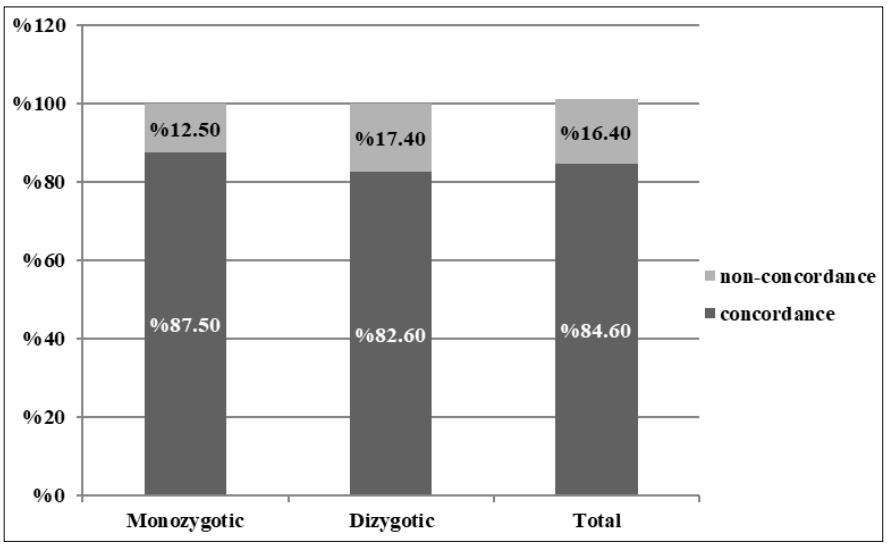

Fig 2: Distribution of the concordances of dental injuries among twins

Discussion

Although it is difficult to verify whether the environmental factors are the same in monozygotic and dizygotic twins and to provide a sufficient number of participants, twin studies are very important for examining the effects of genetic and environmental factors [2, 10].

In the literature, some studies have evaluated differences between monozygotic and dizygotic twins in terms of tooth morphology, caries, malocclusion, bacterial colonization, enamel defects, and periodontal diseases [3, 5-8, 11]. The studies on dental caries, malocclusion, dental anomalies, tooth size and morphology have shown that genetic factors as well as environmental factors play an important role [5, 7, 12, 13]. In this study, the prevalence of dental injuries, the genetic differences and the concordance with monozygotic and dizygotic twins were investigated.

This study revealed that the prevalence of dental injuries in twins was 9%. In another study in which the mean age of the participating twin patients was 23.42 ± 12.28, the prevalence of dental trauma was 34.6% [2]. These differences in prevalence are thought to be caused by the age ranges in the studies and geographical, cultural, and environmental factors. This study found a lower prevalence of dental trauma when compared to the results of other studies in 0–18 years of age children [14, 15].

A significant difference in gender was observed in the study, in which males more often suffered from a dental injury than females. In another study on twins, no statistically significant relationship was found between genders according to dental trauma [2]. When dental trauma was evaluated in children, males were more exposed to more traumatic dental injuries in many studies [16-19]. It is thought that this situation does not make any difference for this twin study.

When trauma history was evaluated according to the twin status, dizygotic twins experienced more dental injuries compared to monozygotic twins in our study. In the literature, one study reported contrasting results [2]. In our study, ıt was observed that monozygotic twins whose gender was female/female, did not suffer from dental trauma. We determined that females with a twin brother experienced more dental trauma than females with a twin sister in the study. Wasmer *et al*. [2] reported similar results in their study. This situation was explained by the fact that females with a twin brother in an opposite-sex twin pair had masculinized behavior and an anatomic structure as a result of exposure to testosterone from male fetuses in the uterus [20, 21]. This may be why females with a twin brother have similar activities as their brothers.

When the results of studies on dental trauma were examined, the most cause of traumatic dental injuries was falls [17, 22, 23]. Dental trauma in younger children occur mostly at home, adolescents suffer trauma most frequently in the street and at school [24, 25], and the most frequently traumatized teeth were the upper incisors in both permanent and primary dentition [16, 17, 22]. In this study, among the etiological factors, falls (65%) was first, followed by collision (25%). Upper incisors were the most affected teeth, and this is an expected result when the position of the upper incisors is taken into consideration. When age ranges were considered, patients who had crown fractures and luxation traumas were close to each other. While dental trauma was most frequently seen in the street in twins (40%), the percentage of trauma occurring in the home was also high (35%) due to the fact that half of the patients were children in the primary dentition period when they were exposed to trauma. In addition to these results, only one tooth was traumatized in 57.9% of cases. This finding is consistent with previously published studies [16, 17, 22].

Some predisposing anatomical factors can increase the susceptibility to dental trauma. Increased overjet has been shown to be one of the etiological risk factors of traumatic injuries and is characterized by environmental influences during development [2, 26]. In the literature, it was stated that children with greater than 3mm overjet are nearly twice the risk of trauma as those with an overjet of less than 3mm [27]. In this study, it was found that seven of the twenty patients with a dental trauma history had overjet with 3-4 mm or more. In a study, no significant difference was observed in terms of traumatic tooth injuries due to strong genetic effects in monozygotic twins, but not in dizygotic twins [2]. In this study, 87.5% of the monozygotic twin pairs and 82.6% of the dizygotic pairs were concordant. There was no statistically significant difference in concordance for dental trauma between the monozygotic and dizygotic twins. This result shows that it is important to evaluate environmental factors when determining the risk factors for dental injuries in twins.

Conclusion

In conclusion, it was determined that in dizygotic twins dental traumatized patients were more than monozygotic twins, but there was no difference in concordance between the monozygotic and dizygotic twins in terms of exposure to dental trauma. Environmental factors may play an significant role to determine the differences between twins. To evaluate the relationship between environmental and genetic factors on dental trauma, there is definitely a need for further twin researches with a large population based study group.

Acknowledgement

This paper has been edited for English by a native editor from Wordvice Editing Service with a process number 62355. All authors declare that they have no relationship with any people/organizations that could inappropriately influence their work.

References

1. Andreasen JO, Andreasen FM, Andersson L. Textbook and Color Atlas of Traumatic Injuries to the Teeth, Blackwell, Oxford, UK, 4th edition, 2007.
2. Wasmer C, Pohl Y, Filippi A. Traumatic dental injuries in twins: is there a genetic risk for dental injuries? Dent Traumatol. 2008; 24(6);619-624.
3. Townsend GC, Richards L, Hughes T, Pinkerton S, Schwerdt W. The value of twins in dental research. Aust Dent J. 2003; 48(2):82-88.
4. Pal GP, Mahato NK. Genetics in Dentistry. 1st ed., New Delhi, India: Jaypee, 2010.
5. Anu V, Arsheya GS, Anjana V, Annison GK, Lakshmi Aruna MR, Alice AP *et al*. Dental caries experience, dental anomalies, and morphometric analysis of canine among monozygotic and dizygotic twins. Contemp Clin Dent. 2018; 9(2):314-317.
6. Boraas JC, Messer LB, Till MJ. A genetic contribution to dental caries, occlusion, and morphology as demonstrated by twins reared apart. J Dent Res. 1988; 67(9):1150-1155.
7. Kabban M, Fearne J, Jovanovskı V, Zou L. Tooth size and morphology in twins. Int J Paediatr Dent. 2001; 11(5):333-339.
8. Kawala B, Antoszewska J, Necka A. Genetics or environment? A twin method study of malocclusions.

World of Orthod. 2007; 8(4):405-410.
9. Piekoszewska-Ziętek P, Turska-Szybka A, Olczak-Kowalczyk D. State of dentition among twins considering the ınfluence of genetic and environmental factors: The systematic review of the literature. Dent Med Probl. 2016; 53(4):510-523.
10. Harris EF, Potter RH. Sources of bias in heritability studies. Am J Orthod Dentofacial Orthop. 1997; 112(3):17-21.
11. Ooi G, Townsend G, Seow WK. Bacterial colonization, enamel defects and dental caries in 4-6-year-old mono- and dizygotic twins. Int J Paediatr Dent. 2014; 24(2):152-160.
12. Lovelina FD, Shastri SM, Kumar PD. Assessment of the oral health status ofmonozygotic and dizygotic twins - A comparative study. Oral Health Prev Dent. 2012; 10(2):135-139.
13. Jeong KH, Kim D, Song YM, Sung J, Kim YH. Epidemiology and genetics of hypodontia and microdontia: a study of twin families. Angle Orthod. 2015; 85(6):980-985.
14. Azami-Aghdash S, Ebadifard Azar F, Pournaghi Azar F, Rezapour A, Moradi-Joo M, Moosavi A *et al*. Prevalence, etiology, and types of dental trauma in children and adolescents: systematic review and meta-analysis. Med J Islam Repub Iran. 2015; 29(4):234.
15. Oldin A, Lundgren J, Nilsson M, Noren JG, Robertson A. Traumatic dental injuries among children aged 0–17 years in the BITA study - a longitudinal Swedish multicenter study. Dent Traumatol. 2015; 31(1):9-17.
16. Kırzıoglu Z, Erturk S, Karayılmaz H. Traumatic injuries of the permanent incisors in children in southern Turkey: a retrospective study. Dent Traumatol. 2005; 21(1):20-25.
17. Karayilmaz H, Kirzioglu Z, Erken Gungor O. Aetiology, treatment patterns and long-term outcomes of tooth avulsion in children and adolescents. Pak J Med Sci. 2013; 29(2):464-468.
18. Soares TRC, Silva LP, Salazar SLA, Luiz RR, Risso PA, Maia LC. Profile of intrusive luxation and healing complications in deciduous and permanent teeth – a retrospective study. Acta Odontol Scand. 2018; 76(8):567-571.
19. Zengin AZ, Celenk P, Sumer AP, Cankaya S. Evaluation of traumatic dental injuries in a group of Turkish population. Niger J Clin Pract. 2015; 18(1):86-89.
20. Cohen-Bendahan CC, Buitelaar JK, van Goozen SH, Orlebeke JF, Cohen-Kettenis PT. Is there an effect of prenatal testosterone on aggression and other behavioral traits? A study comparing same-sex and opposite-sex twin girls. Horm Behav. 2005; 47(2):230-237.
21. Lummaa V, Pettay JE, Russell AF. Male twins reduce fitness of female co-twins in humans. Proc Natl Acad Sci USA. 2007; 104(26):10915-10920.
22. Kirzioğlu Z, Karayilmaz H, Ertürk MS, Köseler Sentut T. Epidemiology of traumatised primary teeth in the west-Mediterranean region of Turkey. Int Dent J. 2005; 55(5):329-333.
23. Díaz JA, Bustos L, Brandt AC, Fernández BE. Dental injuries among children and adolescents aged 1-15 years attending to public hospital in Temuco, Chile. Dent Traumatol. 2010; 26(3):254-261.
24. Goyal N, Singh S, Mathur A, Makkar DK, Aggarwal VP, Sharma A *et al*. Traumatic dental injuries prevalence and their impact on self-esteem among adolescents in India: A comparative study. J Clin Diagn Res. 2017; 11(8):106-110.
25. Glendor U. Aetiology and risk factors related to traumatic dental injuries-a review of the literature. Dental Traumatol. 2009; 25(1):19-31.
26. Burden DJ. An investigation of the association between overjet size, lip coverage, and traumatic injury to maxillary incisors. Eur J Orthod. 1995; 17(6):513-517.
27. Nguyen QV, Bezemer PD, Habets L, Prahl-Andersen B. A systematic review of the relationship between overjet size and traumatic dental injuries. Eur J Orthod. 1999; 21(5):503-515.