

# Incisor trauma in a Turkish preschool population: Prevalence and socio-economic risk factors

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**Objective:** This study aimed to assess the prevalence of traumatic injuries of the primary incisors in preschool children from 2 to 5 years old in South-Eastern Anatolia, Turkey. Additionally, the relationship between traumatic dental injuries, parents' education level, family income, size of incisal overjet and the presence of anterior open bite were examined. **Basic research design:** A cross-sectional survey **Clinical settings:** Data were collected through oral examinations and structured interviews, and included socio-economic indicators. **Participants:** A total of 727 children of both genders were included in the study. 122 of these children were aged 2; 183 aged 3; 178 aged 4 and 186 aged 5. **Results:** The prevalence of dental injuries was 8.0% (n=58). The highest frequency of trauma in the primary teeth was observed at the age of 4. Boys experienced more dental injuries than girls, 12.2% and 4.0%, respectively. The most common crown fracture was in enamel only (57%) followed by crown fracture of enamel and dentin (19%). **Conclusion:** The prevalence of dental injuries in Turkish preschool children was very low. The children with incisal overjet greater than 5mm and anterior open bite experienced more dental injuries in primary teeth than their counterparts with normal occlusion. Socio-economic indicators were not statistically significantly associated with the occurrence of traumatic dental injuries.

**Key words:** traumatic dental injury; socio-economic indicators; primary teeth; overjet; anterior open bite

## Introduction

The prevalence of dental trauma in preschool children is a continuing clinical and dental public health problem. Injuries to primary dentition are important because of the potential for periapical sequelae, which can adversely affect the development of the permanent teeth and the developing occlusion (Carvalho *et al.*, 1998; Fried and Erickson, 1995; Holland *et al.*, 1988; Rodríguez *et al.*, 2007). In a retrospective study, Andreasen and Ravn (1972) reported that 30% of children suffered dental trauma before age 7. Dental injuries may impact on children's quality of life. Most dental injuries involve the anterior teeth, which may lead to restriction in biting, difficulty in speaking clearly, and embarrassment of showing teeth.

Epidemiological data provide a basis for evaluating the concepts of effective treatment, resource allocation and planning within any health environment (Bastone *et al.*, 2000). The prevalence of dental trauma in various epidemiological studies differs considerably (Bastone *et al.*, 2000, Holland *et al.*, 1988, Wilson, 1995). The variation has been related to several factors such as type of study, trauma classification, differences in methodology, limited age groups and geographic and behavioral differences between study locations and countries (Sandalli *et al.*, 2005). Nevertheless, there are few studies of the prevalence of traumatic injury to the primary dentition in children aged 2–5 years.

Traumatic dental injuries (TDI) are associated with biological, socio-economic, psychological and behavioural factors and predisposing factors include increased incisal overjet, open bite, protrusion and lip incompetence (Cortes *et al.*, 2001). As accidents are the main cause of dental injuries, one might expect a similar association between dental injuries and socio-economic background. However, very few studies have included socio-economic status in their reports and, among those that have, there are conflicting results.

The purpose of this study was to evaluate the prevalence of traumatic injuries to the primary incisors in preschool children with both genders and aged between 2–5 years in Diyarbakır, Turkey. In addition, the study aims to confirm whether dental injuries are related to the age and gender of the child, the size of incisal overjet, the presence of anterior open bite, and also to test the association between parents' level of education and socio-economic status with dental injuries.

## Methods

A cross-sectional survey was carried out in South-Eastern Anatolia, Turkey in 2008. Some 727 children (354 boys, 373 girls) aged between 2–5 years and all attending nursery schools in Diyarbakır, Turkey were included in this study: 122 of these children were aged 2; 183 were 3; 178, aged 4 and 186, 5.

Ethical clearance was obtained from the Ethical Committee of the Faculty of Dentistry, University of Dicle. A pilot study was carried out to test the feasibility of the study, the dental examination and the interview procedures. The questionnaire was also piloted and proved to be applicable to the Turkish population and appropriate for their reading levels. There was no need to change the previously proposed methodology.

Local authorities (Health Council and The Education Council) provided the necessary information for the construction of a sample frame. The following information was obtained: the names of nursery schools in Diyarbakır, their addresses and total number of children (778) in each nursery school by age. A letter was sent to the parents of all children explaining the aim, characteristics and importance of the study, and asking for their participation. Negative consent was accepted without any prejudice being attached to the children who had opted not to participate. Of these 778 children, all attending nursery schools; 51 were excluded because of their parents' being unwilling to participate in the study. Socio-demographic data included age, gender, parents' level of education and income. A questionnaire was sent to the parents of children to assess level of education of parents and income. Family income was calculated based on monthly wages of economically active members of the family and divided according to the current Turkish Minimum Wage (TMW= €350).

All dental examinations were carried out by two dentists (ECT, ÖA) who participated in a training and calibration exercise for the criteria used to identify dental injuries. The criteria used to assess traumatic dental injuries were derived from a modified version of Ellis' classification. It included fracture of the crown involving the enamel only, fracture of the crown involving enamel and dentin, fracture of the crown involving the pulp, tooth missing due to trauma. In addition to those criteria the presence of tooth discoloration was recorded. Pulp involvement was assessed through the presence of discoloration and presence of fistulous tract without signs of caries. Root fractures and pulp status recorded in Ellis' classification were not recorded in this study. The children were examined in a chair at nursery schools during class hours in predetermined order in a private room under natural light. Sometimes, very young children were held by their parents. Gauze squares, cotton buds and sterile sets of plane mouth mirrors, periodontal probes were packed in sufficient quantities for each day. The examiners wore new gloves for each clinical examination. The dental examination for traumatic dental injuries included only maxillary and mandibular primary incisors. Registration of the original overjet was repeated on 50 children within a 4 week interval by the same observer. The measurement error was found to be 0.24mm. Furthermore; the examiners recorded the size of incisal overjet and the presence of anterior open bite. Incisal overjet was measured, using periodontal probes, from the buccal surface of the most protrusive primary mandibular incisor to the buccal surface of the most protrusive primary maxillary central incisor on the children. Overjet was considered to be a risk factor when it presented values higher than 5mm, and the presence of anterior open bite was assessed based on the criterion of lack of vertical

overlap of the incisors in the occlusal position (Jones *et al.*, 1993). Data were collected through oral examinations and structured interviews, and all recording forms were numbered but not named.

All results were analyzed using the Statistical Package for Social Sciences (SPSS) software, version 15.0 and the Medcalc version 9.4.2.0. Data analysis included descriptive statistics (frequency distribution and cross-tabulation). Statistical significance for the association between the occurrence of traumatic dental injuries and distribution of dental injuries by age and gender, parents' level of education, family income, children's incisal overjet size and the presence of anterior open bite was determined using the Chi-square test, Fisher's exact tests and binary logistic regression analysis. The level of significance was set at 5%.

## Results

Some 727 children (354 boys, 373 girls) aged 2-5 years attending nursery schools in Diyarbakır, Turkey during 2008 were included in this study. Table 1 presents their distribution by age and gender. The prevalence of traumatic injuries to their teeth was 8.0% (Table 1). Those aged 4 experienced more trauma (16.4%), with the male gender predominating all of the groups; the difference was statistically significant ( $p < 0.001$ ). Boys experienced more dental injuries than girls (12.2% cf 4.0%,  $p < 0.001$ ), respectively.

The most common crown fracture was in enamel only (57%), followed by crown fracture of enamel and dentin (19%, Table 2). Discoloration following trauma occurred in 16% of those with TDI. In this distribution of types of injuries there were no differences by gender ( $p = 0.376$ ).

**Table 1.** Prevalence and distribution of dental injuries in the primary dentition by age and gender

Age years	Gender	Number with dental injuries	Number examined	%	Significance <i>p</i> , Fisher's Exact Test
2	Boys	1	52	1.9	0.423
	Girls	0	71	0.0	
	All	1	123	0.8	
3	Boys	9	105	8.6	0.133
	Girls	2	89	2.3	
	All	11	194	5.7	
4	Boys	26	101	25.7	<0.001
	Girls	9	112	8.0	
	All	35	213	16.4	
5	Boys	7	96	7.3	0.533
	Girls	4	101	4.0	
	All	11	197	5.6	
2-5*	Boys	43	354	12.2	<0.001
	Girls	15	373	4.0	
	All	58	727	8.0	

\* $\chi^2 = 20.21$

**Table 2.** Distribution of affected teeth in relation to different types of dental injuries

<i>Type of dental injury</i>	<i>n</i>	<i>%</i>
Crown fracture of enamel only	40	57
Crown fracture of enamel and dentin	13	19
Crown fracture involving pulp	2	3
Missing teeth following a trauma	2	3
Presence of fistulous tract without signs of caries	2	3
Discoloration following trauma	11	16
Total	*70	100

\*There were a total of 70 affected teeth among the 58 children with dental injuries.

**Table 3.** Frequency distribution of traumatic injuries to the primary incisors in a sample of preschool children by gender, socio-economic indicators, size of the overjet and anterior open bite status

<i>Subgroup</i>	<i>Number with dental injury</i>		<i>Number in subgroup</i>		<i>p value, <math>\chi^2</math> test</i>
	<i>n</i>	<i>(% in subgroup)</i>	<i>n</i>	<i>(% of all)</i>	
<b>Gender</b>					
Boys	43	(12.2)	354	(48.7)	<0.001
Girls	15	(4.0)	373	(51.3)	
<b>Father's education</b>					
≤8 years	2	(5.9)	34	(4.7)	0.763
>8 years	56	(8.1)	693	(95.3)	
<b>Mother's education</b>					
≤8 years	9	(6.5)	139	(19.1)	0.601
>8 years	49	(8.3)	588	(80.9)	
<b>Family income</b>					
Low (≤€350)	13	(5.7)	227	(31.2)	0.142
High (>€350)	45	(9.0)	500	(68.8)	
<b>Overjet</b>					
≤5mm	19	(3.2)	591	(81.3)	<0.001
>5mm	39	(28.7)	136	(18.7)	
<b>Anterior open bite</b>					
Yes	41	(31.1)	132	(18.2)	<0.001
No	17	(2.9)	595	(81.8)	
All	58	(8.0)	727	(100)	

**Table 4.** Results of binary logistic regression of explanatory variables on injuries to the anterior primary teeth (n=727)

<i>Variables</i>	<i>B</i>	<i>S.E.</i>	<i>Wald</i>	<i>df</i>	<i>p value</i>	<i>Exp (B) (Odds ratio)</i>	<i>95% CI for Exp (B) (Odds ratio)</i>
Age	0.020	0.015	1.702	1	0.192	1.020	0.990 , 1.052
Gender	- 0.983	0.375	6.856	1	0.009	0.374	0.179 , 0.781
Mother's education	- 0.733	0.444	2.722	1	0.099	0.481	0.201 , 1.148
Overjet	-2.390	0.355	45.322	1	0.000	0.092	0.046 , 0.184
Anterior open bite	-2.741	0.357	58.966	1	0.000	0.065	0.032 , 0.130
Constant	0.284	0.797	0.127	1	0.722	1.328	- -

Socio-economic indicators, namely father's and mother's levels of education and family income were not associated with the occurrence of traumatic dental injuries ( $p=0.763$ ,  $0.601$  and  $0.142$ , Table 3). Children with incisal overjet greater than 5mm experienced more dental injuries ( $p<0.001$ , Table 3). Likewise, Children with anterior open bite also experienced more dental injuries in primary teeth than their counterparts with normal occlusion ( $p<0.001$ , Table 3).

Modelling including all independent variables ( $\chi^2=158.206$ ;  $p<0.001$ ), there was an increase in the agreement with the inclusion of independent variables. According to binary logistic regression analysis, TDI were not significantly related to age ( $p=0.192$ ) or level of mother's education ( $p=0.099$ ). Moreover, results of binary logistic regression analysis confirmed that gender of the child ( $p=0.009$ ), incisal overjet ( $p<0.001$ ) and anterior open bite ( $p<0.001$ ) were associated with the occurrence of TDI (Table 4).

## Discussion

This cross-sectional survey identified a prevalence of traumatic dental injuries to the primary incisors in 2-5-year-old nursery school children in Diyarbakır. The prevalence was very low (8.0%) compared with other studies across many countries using the same method and diagnostic criteria. In Cuba the prevalence of dental injuries in 2-5-year-olds was 34.2% (Rodríguez, 2007) and in Belgium 18.0% for 3-5 year-olds (Carvalho *et al.*, 1998). According to retrospective and prospective studies reported in the literature, the prevalence of traumatic injuries involving the primary dentition ranged from 4% to 37% (Andreasen and Ravn, 1972; Carvalho *et al.*, 1998; Fried and Erickson, Jones *et al.*, 1995, Rodríguez, 2007, 1993, Tumen *et al.*, 2009). However, a care should be taken when comparing prevalence figures with studies that have used different methodologies.

The literature report the highest incidence of dental trauma in children aged 12-36 months as the child was in the process of gaining mobility and independence, yet lacked full coordination (Bastone *et al.*, 2000). Furthermore the parents' anxiety in seeking dental care was higher in very young children, even after small traumatic accidents, which could affect the reported incidence in this age group (Wilson, 1995). However, in a cross-sectional study, it was stated that more traumatic dental injuries had been recorded in older children probably because the register of injuries to hard tissues was usually cumulative (Oliveira *et al.*, 2007). On the contrary, our data showed the drop back from 16% in 4 year olds to 6% in 5 year olds.

Boys presented more traumatic injuries than girls corroborating the findings of Cortes and colleagues (2001). The difference may be explained by behavioral or even cultural factors. Moreover, the high incidence in boys is probably related to their more vigorous play styles and more aggressive nature of this age group (4 years) compared to girls (Oliveira *et al.*, 2007). On the other hand, some studies have already indicated an increasing trend of dental trauma among girls, because of their increasing participation in sports or activities formerly practiced by boys only (Gutmann and Gutmann, 1995).

Traumatic dental injuries in different age groups may not be related with socio-economic indicators. The incidence of these dental injuries is explained by the developing motor coordination, greater activity and lack of cooperation between children aged 2-5 years.

The most common forms of damage were fractures in enamel only followed by fractures in enamel and dentine (O'Brien, 1994). In other published studies, crown fractures were also the most common type of injury, with prevalences of trauma involving primary teeth ranging from 64% to 90% (Garcia-Godoy *et al.*, 1983, Yagot *et al.*, 1988). In the present research, enamel fractures dominated (57%) followed by enamel-dentin fracture (19%) and discoloration (16%).

Some studies used income and measures of social status. The findings, however, were equivocal with associations between higher socio-economic status and increased trauma being identified as positive (Cortes *et al.*, 2002), nonexistent (Marcenes *et al.*, 2000) and negative (Alonge *et al.*, 2001, O'Brien, 1994). Further research needs to be carried out to elucidate the role of socio-economic indicators in the occurrence of traumatic injuries to the teeth. In the present research neither mothers' education nor family income were associated with likelihood of dental injuries ( $p=0.601$ ,  $0.142$ ).

Most previous studies reported an association between the size of the incisal overjet and presence of dental injury (O'Brien, 1994; Jarvinen, 1979). However, other studies showed no significant relation between incisal overjet and TDI (Marcenes *et al.*, 2000). In relation to overjet, different authors have argued over which particular value should be regarded as an increased overjet. Thus, some recognize an increased overjet when the value is over 3mm (Jarvinen, 1979), and others when over 5mm (Cortes *et al.*, 2001; Marcenes *et al.*, 2000). In the present study, it was also found that children with incisal overjet greater than 5mm experienced more dental injuries ( $p<0.001$ ).

According to Nguyen and colleagues (1999) children presenting with an anterior open bite are more prone to trauma and the maxillary incisors are the teeth most frequently involved. The present research also showed that children with an anterior open bite had experienced more dental injuries ( $p<0.001$ ). The results suggest that in younger children, anterior open bite is an important predisposing factor of injuries to primary incisors.

## Conclusion

The prevalence of dental injuries in primary teeth in Turkish preschool children was very low and unaffected by mothers' educational level or their socio-economic status. Factors associated with increased risk of dental injuries were being a boy, having an incisal overjet greater than 5mm and having anterior open bite.

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