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Traumatic dental injuries in an urban adolescent population in Tirana, Albania

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Abstract – *Aim*: The aim of this study was to gather information about traumatic dental injuries (TDI) in an urban adolescent Albanian population. *Material & methods*: A cross-sectional survey was carried out to acquire epidemiological data about TDI in the permanent incisors of Albanian adolescents. Participants (n = 2789) were adolescents of both genders, aged 16–18 years, attending public high schools in Tirana. *Results*: The occurrence of TDI in the incisors ranged from 8.9% of 16-year-olds to 10.5% of 18-year-olds. A greater proportion of boys (12.4%) had TDI compared with girls (7.7). The most commonly reported causes were collisions (27.5%) followed by physical leisure activities and sports (mainly cycling and swimming/diving) (14.1%) and falls (13.4%). Of the adolescents affected by TDI, 32% had unmet treatment need because of no or inadequate treatment. Adolescents living in districts with low socio-economic level had significantly more TDI with unmet treatment need than those living in districts with high socio-economic level. *Conclusion*: The occurrence of TDI among Albanian adolescents was moderate. Adolescents who came from low socio-economic districts had a greater probability of having TDI with unmet treatment need.

Traumatic dental injury (TDI) occurs frequently and mainly affects children and adolescents. Injuries to oral tissues are the sixth most common body injury, although the oral area represents just 1% of the body (1). TDI is principally a problem for the victim, but becomes an important public health problem (2, 3). Oral injuries vary in severity from minor injuries of the soft and hard tissues to more complex injuries. They may result in extensive loss of teeth and supporting bone and may lead to aesthetic deformity or interference with normal occlusion. Other consequences of TDI may be of emotional and psychological nature (4) and it may have an impact on quality of life (5, 6). Managing the consequences of oral and dental injuries to children and adolescents involves much time for parents and guardians. From a public health point of view, there are both direct and indirect costs that society must bear (7–9). One of the few prospective studies with reliable data reported that more than one-third of children and adolescents had experienced one or more episodes of TDI by the time they reach the age of 16 years (10). Most studies related to the prevalence of TDI are cross-sectional. Published reports from the last decade indicate that the prevalence of dental trauma in permanent teeth ranges from 4.1% to 58.6% (3, 11, 12). This variation may be attributed to different sampling methods, age groups studied or different classifications of TDI in the different studies (13, 14).

There are few published reports highlighting the relationship between socio-economic status and TDI, and they present conflicting results (15–17). Some studies reported that TDI is significantly more frequent in children and adolescents from higher socio-economic backgrounds (15). Conversely, one study found the opposite association (16), while some other studies did not find any association (17, 18).

TDI is most frequently a result of falls, collisions, sports, traffic accidents and violence (19, 20). Boys are normally more prone to TDI compared with girls (15, 16, 19, 21, 22) but the association is changing, possibly as a result of girls' increased involvement in sporting activities (3, 23).

Previous studies have reported that treatment in TDI cases has been deficient or neglected (2, 24, 25). Despite the widespread nature of TDI, there are few published epidemiological studies related to this issue from southern and Eastern Europe and little information regarding occurrence of TDI is available from Albania. The aim of this study was to describe, using epidemiological data, TDI in an urban adolescent Albanian population.

Material and methods

A cross-sectional survey was conducted in Tirana in October and November 2006. Tirana, the capital of Albania, is characterized by a culturally homogeneous population covering a wide range of socio-economic levels. Albania's population is one of the youngest one in Europe. Persons under the age of 15 years make up a third of its 3.1 million inhabitants, and younger than 18 years are 40% of the population (26). The population

of Tirana was 596 000, according to the Albanian Institute of Statistics (INSTAT) (27) in 2005.

Population

The target population was adolescents, aged 16–18 years, attending public high schools in Tirana (3rd–4th grade students). Data on school system, number of registered students and their names were obtained from the Albanian Ministry of Education and the Local Directory of Education (LDE) in Tirana (28). The school system in Albania includes both public and private schools, but the vast majority of high school students in Tirana attend public schools (24 476 students of a total number of 29 109 students registered at the beginning of 2006). The number of students in 3rd and 4th grades in public high schools in Tirana was 11 300 in 2006.

Formula for prevalence studies was used to calculate the sample size (29). The 95% confidence interval and standard error 2.5% or less was applied. A prevalence of 8.3% was used for the calculation based on a previous pilot study among children and adolescents (age 6–18 years) in public schools in Tirana. The minimum sample to fulfil the requirement was estimated to be 468 students at each age group.

Twenty-three public schools were listed by the LDE (28). The schools were geographically distributed in 11 districts in Tirana city. Of these districts, two were of high, four were of medium and five were of low socio-economic level, based on the unemployment rate and the number of families that benefited from social aid, according to INSTAT and the register of the municipal authorities.

The project was approved by the Regional Ethics Committee in Albania, the Ministry of Health, Tirana, Albania, the LDE and the respective school authorities. However, this approval was based on the premise that the study be conducted in the schools having a properly equipped dental surgery. These schools are also those with the highest numbers of students. Eight schools met this requirement, but two of these schools declined to participate in the study because of curricular pressures. The final six participating schools accepted students from 6 of the 11 districts in Tirana (all geographic and socio-economic districts were represented). The six schools (3rd–4th grade students) contained a total of 3475 students. At the meetings to recruit participants, information was supplied to the students who attended. They were given a letter of invitation and a consent form for their parents/guardians, explaining the aims and the importance of the study. On these days, 511 students were absent from school and a further 61 students declined to participate for various reasons, leading to a final number of 2903 participants. Only consenting students were accepted as participants in the study.

Clinical examination

Identification of TDI were conducted by two trained research assistants and by the principal investigator (DST) in the school dental clinic under standardized condition. Using colour photographs, calibration exercises were undertaken before the field work started. The diagnostic criteria used in the study were discussed in detail beforehand. A modified version of the index by O'Brien (30) was used to identify cases of TDI (Table 1). The modification of the index created two new categories (categories five and six in Table 1) and rendered the index more sensitive, allowing the identification of TDI cases with unmet treatment need, even after treatment (sequelae of TDI). All further clinical examinations were undertaken in the school dental clinic by the principal investigator (DST). For each examination, the examiner wore new gloves and used a sterile (single use) set of instruments comprising a plane mouth mirror and a No. 9 probe. Dental caries was recorded at tooth level using the DMFT index as described by WHO Oral Health Surveys (31), where the D (decayed), M (missing) and F (filled) components were recorded separately.

Table 1. Criteria for identifying traumatic dental injuries[1]

Trauma category	
0	Tooth present, no evidence of trauma
1	Unrestored enamel fracture that does not involve dentine
2	Unrestored fracture that involves dentine
3	Untreated damage as evidenced by: a) Discoloration (dark due to pulp necrosis, yellow due to pulp canal obliteration and red/pink due to invasive root resorption or haemorrhage) as compared with neighbouring teeth and the contra-lateral tooth b) Presence of a swelling or fistula in the labial or lingual vestibule adjacent to an otherwise healthy tooth
4	Fracture restored either with a full crown or a less extensive restoration. The subject should have a positive history of traumatic dental injury for this code to be assigned. Presence of a lingual restoration as a sign of endodontic therapy, or temporary filling along with a history of RCT following injury is also assigned this code
5	As trauma category 4, but with the presence of either a) or b): a) Discoloration (dark due to pulp necrosis, yellow due to pulp canal obliteration and red/pink due to invasive root resorption or haemorrhage) when compared with neighbouring teeth and the contra-lateral tooth b) Swelling or fistula in the labial or lingual vestibule adjacent to an otherwise healthy tooth
6	Tooth missing due to trauma but replaced by denture, bridge or implant. A positive history of traumatic dental injury is needed for this code to be assigned.
7	Tooth missing due to trauma – not replaced. A positive history of traumatic dental injury is needed for this code to be assigned
9	Any tooth or tooth space not categorized as 0 through 7

[1]Modification of the Trauma Index by O'Brien (30).

Questionnaire phase

The participants who had experienced at least one TDI completed a self-administered structured questionnaire after the clinical examination in the dental surgery. A dental assistant, blind to the aims of the study, assisted any students who had difficulties with the questionnaire.

A pilot study was carried out prior to data collection in 10 randomly selected 16- to 18-year-old students to

test the protocol. The interview format was tested and adjusted before data collection started.

The questionnaire covered socio-demographic characteristics such as age, gender and parental educational level. Education level was measured by mother's educational level (> 12 years of education was considered high, and ≤12 years of education was considered low). Furthermore, using the questionnaire information regarding the event of TDI such as location (where) and type (how the injury happened) was collected by giving fixed alternatives including an alternative 'I do not remember'.

Participation in sporting activities was recorded as: (i) I am regularly part of a team/sporting activity, (ii) I play with friends often during the week, (iii) I do sporting activities/play once per week, (iv) I do sporting activities/play seldom and (v) I am really a coach potato. If the respondent confirmed regular participation in sporting activities, there followed questions about the use of a mouth guard. This was recorded: (i) I use a mouth guard; (ii) I do not use one. If the respondent confirmed not using a mouth guard while playing, a question asked why. This was recorded as (i) No one has told me to wear one, (ii) I do not think I need one, (iii) Too expensive, (iv) I don't know where to get one, (v) I don't look good wearing one, (vi) Makes it difficult to breathe or talk/uncomfortable and (vii) Other reasons. The frequency of TDI events was recorded based on the responses to the following items in the questionnaire: (i) Once, (ii) Twice, (iii) More than twice and 4) Do not remember.

Reliability

A sub-sample of 45 students was re-examined and filled out the questionnaire again after 10–14 days for validation purposes (inter- and intra-examiner reliability). The inter-examiner reproducibility test was performed between each of the dentists and the first author. For identifying students with TDI, Cohen's Kappa value for agreement between examiners ranged from 0.94 to 1.0. Intra-examiner reliability for the principal investigator (clinical parameters) ranged from Kappa = 0.78 for the DMFT and 1.0 for TDI, i.e. from good to excellent agreement (32). The Kappa value for the questionnaire items ranged from 0.74 for the question related with the frequency of the TDI events to 1.0 for the question related to the use of mouth guard. These figures indicate very good intra-examiner reliability, according to WHO (33).

Data processing and analysis were carried out using the Statistical Package for Social Sciences (SPSS), version 14.0. Frequencies, means and cross-tabulation with Pearson's chi-square test for associations of traumatic dental injuries (TDI) and relevant variables were calculated. Simple and multiple logistical regression analysis was used to assess the relationship between TDI with unmet treatment need vs no further treatment need and othervariables such as gender, district, age and mother's educational level. The level of significance was set at 0.05.

Results

From the 2964 pupils invited to participate in the study, 2903 agreed to participate (aged 16–19 years). The number of adolescents aged 19 years (n = 114) was lower than that calculated as necessary for each age group so this age group was excluded from the statistical analysis. For the other age groups, the sample size was above the minimum required number. Thus, the final sample comprised 2789 subjects (Table 2).

Table 2. Frequency of traumatic dental injuries (TDI) according to age and gender

Age	Gender	TDI (%)	No TDI (%)	*P*-value
16 years	Boys	31 (11.6)	237 (88.4)	0.01
	Girls	21 (6.7)	294 (93.3)	
	All	52 (8.9)	531 (91.1)	
17 years	Boys	80 (11.9)	591 (88.1)	0.04
	Girls	60 (8.1)	678 (91.9)	
	All	140 (9.9)	1269 (90.1)	
18 years	Boys	51 (13.8)	317 (86.2)	0.03
	Girls	33 (7.7)	396 (92.3)	
	All	84 (10.5)	713 (89.5)	
Total 16–18 years	Boys	162 (12.4)	1145 (87.6)	0.01
	Girls	114 (7.7)	1368 (92.3)	
	All	276 (9.9)	2513 (90.1)	

Among the adolescents participated in this study, 47% were boys. The mean age of the participants was 17.5 years. Frequency distribution of age and gender are given in Table 2. For the whole group, boys were significantly more affected by TDI episodes than the girls (P = 0.01). This difference was significant at each age level (Table 2). Having had a TDI increased cumulatively with age from 8.9% at the age of 16 years old to 10.5% at 18 years old (Table 2).

The distribution of TDI according to district (socio-economic levels) is shown in Table 3. The majority of the students came from districts representing medium- and low- socio-economic status, which mirrors the distribution of social-economic level in the city of Tirana. No significant differences were found between the occurrences of TDI among the districts representing different socio-economic levels.

Most of the students affected by TDI (66.3%) had only one traumatized tooth, while 27.5% had two teeth with TDI, and only 1.4% had more than two teeth involved. With regard to how often adolescents have been exposed to TDI events, 85.5% had experienced only one episode, 5.5% more than once and 9% did not

Table 3. Frequency distribution n (2789) of subjects according to district's socio-economic classification

Socio-economic level	Subjects with TDI with unmet treatment need[1]	Subjects with TDI without unmet treatment need	Subjects without TDI	Total
High	26	75	994	1095
Medium	30	66	902	998
Low	33	46	617	696
Total	89	187	2513	2789

[1]The frequency of students affected by at least one TDI coded as category 2, 3, 5 and 7 in Table 1.
TDI, traumatic dental injuries.

Table 4. Experience of traumatic dental injuries (TDI) in a sample of 2789 students (n = 22 312 incisors)

Type of teeth	Frequency[1] (n)	Relative frequency per thousand incisors
Maxilla		
Right lateral (# 12)	36	1.6
Right central (# 11)	134	6.0
Left central (# 21)	149	6.7
Left lateral (# 22)	28	1.2
Mandible		
Right lateral (# 42)	3	0.1
Right central (# 41)	9	0.4
Left central (# 31)	18	0.8
Left lateral (# 32)	6	0.3
Total	383	17.1

[1]All trauma episodes included, i.e. some students experienced TDI on more than one tooth.

Table 5. Different types of traumatic dental injuries (TDI), treatment received, sequelae and types of TDI in 2789 students (n = 22 312 incisors)

Type of TDI	Frequency (n)	Relative frequency per thousand incisors
1. Untreated		
1.1 Treatment not required		
Enamel fracture (coded 1 in Table 1)	162	7.2
1.2 Treatment need		
Enamel and dentine fracture (coded 2 in Table 1)	39	1.7
Discoloration/fistulous tract (coded 3 in Table 1)	11	0.5
Missing tooth (coded 7 in Table 1)	5	0.2
2. Treated		
2.1 Treatment not required		
Restored crown fractures, root canals or missed teeth due to trauma but teeth replaced (Coded 4 and 6 in Table 1)	104	4.7
2.2 Treatment need		
Treated, but discoloration and/or swelling/fistula present (Coded 5 in Table 1)	62	2.8
Total	383	17.1

remember. The teeth most often affected by TDI were maxillary incisors (Table 4).

The most common type of injury was TDI involving only the enamel (7.2 per thousand incisors) (Table 5). A considerable proportion of previously treated TDI still had sequelae such as fistula, abscess or discoloration (2.8 per thousand incisors). The TDI involving the dentine counted for 1.4 per thousand incisors. Other types of TDI such as fistula, discoloration and missing teeth were not so frequent (Table 5). A significant difference between the proportions of students with unmet treatment need coming from low social economics districts when compared with students from high socio-economic level was obtained using Pearson's chi-square test ($P < 0.001$). There was no significant difference between the proportions of girls and boys affected by TDI with unmet treatment need.

Table 6. Distribution of the different causes of traumatic dental injuries

Cause of dental injury	n	%
Traffic accidents	13	4.7
Collision	76	27.5
Fall	37	13.4
Fights/violence	11	4.0
Swimming/diving	25	9.1
Cycling	19	6.9
Physical leisure activities/playing sports/running	39	14.1
Biting hard food	22	8.0
Do not remember	29	10.5
Missing information	5	1.8
Total	276	100.0

The causes of TDI are presented in Table 6. The most common causative factor was collision (27.5%), followed by sports/physical leisure injuries (14.1%) and fall (13.4%).

A total of 41.3% of students affected by TDI were regularly participating in a sports team or sporting activities. Of these students, only 15.7% were wearing a mouth guard while participating in sports activities. The reasons for 'non-wearing' were 'Do not have knowledge at all about them' (74.1%), 'Do not need to wear one while doing sports' (8.6%) and 'Do not know where to get one' (1.6%). A multiple logistic regression analysis was used for testing association between subjects having TDI with and without unmet treatment need against relevant variables such as gender, mother's level of education, socio-economic district and decay status. The analysis revealed that coming from a low socio-economic district was the only significant risk factor, with an odds ratio of 2.6 (95% CI: 1.3–5.4), for having TDI with unmet treatment need (Table 7).

Discussion

Participants in the present cross-sectional study can be considered representative of the urban population of 16- to 18-year old adolescents enrolled in public schools but not of the whole population of adolescents living in Tirana. According to the Ministry of Education in Albania, 24 476 students of a total number of 29 109 registered in 2006 were enrolled in public high schools which educate the majority of students. Data collections took place at school dental clinics, which facilitated standardization. Although the six participating schools were unusual in being equipped with a dental clinic, the schools were situated in areas reflecting different socio-economic levels.

The study identified a moderate occurrence of TDI to the permanent incisors, from 8.9% at the age of 16 years and reaching 10.5% at the age of 18 years. The cross-sectional nature of the study and the lack of radiographs may have contributed to a lower recorded estimate of TDI by not registering injuries where signs and

Table 7. Logistic regression with the dependent variable traumatic dental injuries (TDI) and no further treatment need vs TDI with further treatment need (*n* range 272–276)

Independent variables		TDI; treatment not needed *n* (%)	TDI; unmet treatment need *n* (%)	OR unadjusted (CI = 95%)	OR adjusted (CI = 95%)
Gender	Female	81 (71.1)	33 (28.9)	1	1
	Male	106 (65.4)	56 (34.6)	1.2 (0.7–2.1)	1.1 (0.6–1.9)
Education – mother	>12 years	70 (67.3)	34 (32.7)	1	1
	≤12 years	115 (68.5)	53 (31.5)	0.9 (0.6–1.6)	0.7 (0.4–1.3)
District (socio-economic level)	High	75 (74.3)	26 (25.7)	1	1
	Medium	66 (68.8)	30 (31.2)	1.3 (0.7–2.4)	1.3 (0.7–2.5)
	Low	46 (58.2)	33 (41.8)	2.1 (1.1–3.9)*	2.6 (1.3–5.4)*
Decay status	DT = 0	119 (70.4)	50 (29.6)	1	1
	DT = 1	31 (59.6)	21 (40.4)	1.6 (0.8–3)	1.7 (0.9–3.4)
	DT ≥ 2	36 (66.7)	18 (33.3)	1.2 (0.6–2.3)	1.1 (0.5–2)

*$P < 0.05$.

symptoms were absent at the time of examination, such as luxation injuries and root fractures.

The lack of similar studies in the neighbouring countries makes comparisons of results difficult. Nevertheless, a prevalence of 20.5% was found in adolescents in an Italian study (34). Other cross-sectional studies conducted on an adolescent population have shown great variation in the prevalence of TDI (3, 14). The occurrence of TDI in this study was lower than that reported in Brazil (15, 35, 36), USA (37) and UK (16) but higher than that recorded in India (18) and South Africa (38). The comparison may be invalid because of the differences in sampling methods, age groups studied, diagnostic classifications of TDI used in the different studies and cultural behaviour issues (13, 14).

The occurrence of TDI increased with increasing age; this was as expected and this trend is also found in other studies (2, 15).

There was a significant gender difference in the experience of TDI. A history of TDI was significantly more common in boys overall and within each age group, compared with that in the girls. This finding is consistent with the findings of the previous studies (21, 22, 25, 38–40). However, some studies reported no difference between boys and girls (2, 23). These latter findings may reflect the trend of risk behaviours in modern society in which girls are participating more in sports and physical leisure activities.

Most of the TDI involved the maxillary central incisors. This is in accordance with the previous studies and is explained by the prominent position of these teeth in the dental arch (2, 3, 18, 41).

The main types of incidents that resulted in TDI were reported to be collisions, followed by physical leisure activities and sports (mainly cycling and swimming/diving) and falls. Recall bias is a short-coming of retrospective studies (14); it seems especially to occur in children and adolescents when they have to record the cause of TDI. This may explain the high proportions of adolescents that answered 'I do not remember' to the question about the cause of TDI. Another explanation could be that the real cause of their TDI may have been violence which they did not want to reveal. Furthermore, falls caused by pushing is a form of violence that may under-estimate the association between TDI and violence.

A total of 41.3% of students affected by TDI participated regularly in a team sport, but only 15.7% of them were wearing a mouth guard during sporting activities. The reason of not wearing one was that they 'didn't have any information'. This underlines the need for health policy makers, school and dental staff to inform about the benefits of wearing a mouth guard during sporting activities, particularly in contact sports.

This study showed that the treatment of TDI has been deficient, as also found in other studies (2, 15, 25, 35). Another finding of this study was that adolescents living in districts with low socio-economic levels had significantly more TDI with unmet treatment needs compared with adolescents from high socio-economic districts. Similar findings have been reported from Tanzania (24). A total of 32% of the adolescents affected by TDI had unmet treatment needs, often because of lack of treatment or insufficient or unsatisfactory treatment. The proportion of TDI with unmet treatment need may really be higher, as untreated injuries limited to enamel fractures were the most frequent type of injury and not included in the group with unmet treatment need. To what degree an untreated enamel fracture may add to the treatment need would best be measured by conducting a study that includes the victims' opinions. Another reason why the proportion of TDI may be underestimated is the lack of use of radiographs, which could give more information related to sequelae of TDI.

The higher proportion of adolescents with unmet treatment need may be explained by reforms of the health care system in Albania. From being a country under communist government until the collapse of this régime in 1990, Albania now faces a difficult transition hampered by political and economical instability (26). Public dental health care is also affected by the transition; increased population (27) and limited budget available for the public dental health care system result in limited capacity to provide dental treatment. A person who comes from a low social background may not be able or willing to seek care in the private sector. Unmet treatment need may also be partly explained by inadequate knowledge among dentists regarding the treatment of TDI. Such treatment can be complex, and standardized evidence-based protocols should be applied when treating TDI (42–44).

Untreated TDI have been shown to have negative impacts on the oral health-related quality of life of children and adolescents (5, 6). Health policy makers, school staff and dental professionals have a role to play in reducing the occurrence of TDI and ensuring the provision of adequate treatment.

It can be concluded that the occurrence of TDI in Albanian adolescents was moderate and their treatment has frequently been neglected. Adolescents from low socio-economic backgrounds had a greater risk of having TDI with unmet treatment need compared with their peers from high socio-economic environments.

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