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Impact of traumatic dental injuries with unmet treatment need on daily life among Albanian adolescents: a case–control study

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Abstract – *Background*: Traumatic dental injuries (TDI) are common in children and adolescences. Neglected or inadequate treatment may lead to psychosocial distress during late adolescence. *Aim*: To investigate the potential impact of traumatic dental injuries (TDI) with unmet treatment need, on the quality of life of 16–19 year-olds in Tirana, Albania. *Material and methods*: A case–control survey (1:2) was conducted in public high schools in Albania, comprising 95 subjects affected by TDI with unmet treatment need based on objective clinical signs. Controls ($n = 190$) with no history of TDI were matched by age, sex and belonging to the same school class and group of friends as the respective case. The Oral Impact on Daily Performances (OIDP) index was used to measure the impacts. DMFT, Community Periodontal Index and the Aesthetic Component of the Index of Orthodontic Treatment Need as well as social parameters were recorded. *Results*: The response rate was 98%. Overall, the impact prevalence of OIDP was 88.4% among the cases, and 58.9% among the controls ($P < 0.001$). The most prevalent OIDP impact was 'smiling and showing teeth without embarrassment': cases had significantly higher values than controls (78.9% vs 31.6%). Multiple conditional logistic regression analysis was used to disclose the effect of TDI with unmet treatment need on quality of life by adjusting for possible confounders. Compared to the control group, TDI cases with unmet treatment need are at greater overall risk of impacts measured as OIDP, with an odds ratio of 3.9 (95% CI: 1.6–9.1). *Conclusion*: TDI with unmet treatment need in this sample of adolescents is associated with reduced OHRQoL. Compared to adolescents with no history of TDI, those affected by TDI with unmet treatment need are at greater risk of suffering impacts on OHRQoL in the form of OIDP.

Physical appearance and attractiveness are major concerns during adolescence (1). The face is a key feature of physical appearance (2, 3) and the mouth is an important determinant of facial attractiveness (4, 5). Unattractive teeth have negative social and psychological effects on the individual (6–9) and also on the way he or she is perceived in society (10–12).

Traumatic dental injuries (TDI) affect the integrity of the dental arch by tooth substance loss, alteration of position and/or colour of the teeth, pain, mobility or loss of the entire tooth/teeth. Hence, the aim of treatment of missing or injured teeth should be to restore both impaired oral function and appearance.

Traumatic dental injuries have been studied extensively with reference to epidemiology, risk factors and clinical and financial implications (13–26). Moreover, other studies report a high proportion of TDI with unmet treatment need, particularly among children and adolescences (24, 27–31).

However, in dentistry, as in other branches of medicine, objective measures of the sequelae of facial injuries provide no insight into a patient's perception of the impact of such injury on their daily lives. Clinical assessment of the severity of injury is not necessarily predictive of future psychosocial problems. Sequelae which the clinician assesses objectively as minor, may subsequently become a source of considerable psychosocial distress to the patient, unrelated to the physical severity of the injury sustained (7).

TDI, treated, neglected or inadequately treated, may have profound social psychological or functional impacts on the child or adolescent's quality of life (32–36). Cortes et al. reported that a high proportion (66%) of adolescents with untreated dental traumatic injuries had experienced at least one impact on daily living during the previous 6 months (33).

The impact of oral health on quality of life is an area of rapid growth in research and conceptual development.

There is a general need for more comprehensive documentation of the impact of TDI on the quality of life of adolescents. This would allow guidelines for management of TDI to include not only objective clinical

assessment of the injury but also evaluation of the patient's perception of the impact of TDI on his/her quality of life at a time when concern about facial appearance and attractiveness is paramount.

There is some evidence from studies in England (20, 28) that TDI is more prevalent in children and adolescents from underprivileged backgrounds. Crowded living conditions may be a direct risk factor for trauma and poor parental levels of education may be associated with neglect, i.e. failure to seek adequate treatment for TDI. Cultural attitudes to oral health and poor access to dental services may also be contributing factors to TDI with unmet treatment need. TDI may be regarded as a relevant dental public health issue in deprived areas (28). There are few reports of TDI in developing countries including Albania (25, 26).

The objective of this study was to study the impact of TDI with unmet treatment need on the quality of daily life of adolescents, 16–19 years of age, in Tirana, Albania.

Materials and methods

A case–control survey was conducted in Tirana, the capital of Albania, from October to November 2006. Tirana is the most densely populated city in Albania, with a population of 596,000 inhabitants according to Albanian Institute of Statistics (INSTAT), 2005. There is a wide range of socio-economic levels and the population is culturally homogeneous (37).

Sampling

The study was designed to be large enough to allow a confidence interval of 95% in determining the effect of TDI with objectively assessed treatment need on oral-health-related-quality-of-life (OHRQoL) in adolescents. A difference of 20% on the prevalence of oral impact on daily performance (OIDP) between cases and controls was assumed and used for calculation of the study sample. A similar difference was found in a study in Brazilian schoolchildren (33). Using the sample size formula for case–control study (38), the minimum sample size was estimated to be 59 TDI cases, and 118 matched controls. The prevalence of dental trauma in Tirana has been estimated to 8.3% (39) and the proportion of TDI with objectively assessed treatment need estimated to be 35% (39), thus the minimum number of students to be screened was 2 770.

The target population comprised adolescents, aged 16–19 years, attending public high schools in Tirana (3rd–4th grade students). The school system in Albania comprises both public and private schools, but the vast majority of high school students in Tirana attend public schools (24 476 students out of a total number of 29 109 students registered at the beginning of 2006 according to the Local Directory of Education in Tirana).

Twenty-three public schools were listed by the Local Directory of Education in Tirana. According to The Regional Ethics Committee in Albania the study had to be conducted in the schools with properly equipped dental surgery in order to collect standardized data. Eight schools met this requirement. Two of these schools declined to participate in the study due to the time schedule of their curricula. The final six participating schools were from different geographic and socio-economic regions (two from high-, two from medium-, and two from low social economic level according to INSTAT). The number of 3rd–4th grade students (16–19 years old) in six participating schools was 3,475. Five hundred and eleven students were absent on the respective days when information was presented and students were invited to participate. Thus, 2 964 students were invited to participate in the study. For various reasons, 61 students declined to participate, leading to a final pool of participants of 2 903 adolescents.

Inclusion criteria

The Trauma Index by O'Brien (21) is relatively crude with respect to treatment need and adequacy of treatment provided. Therefore, a modification of the index was done by adding two new categories (categories 5 and 6 in Table 1), and making the index more sensitive with respect to identify cases with unmet treatment need (sequelae of these injuries) even after some treatment. For the purposes of this study, a TDI case was defined as an adolescent aged 16–19 years, affected by at least one TDI with unmet treatment need based on objective clinical signs coded 2, 3, 5, and 7 in Table 1. Each case was matched with two controls, according to the cases age, sex, being in the same class at school and living in the same neighbourhood.

Ethical clearance to conduct the study was granted by the Ministry of Health, Tirana, Albania, the Local Directory of Education in Tirana, and the respective school authorities. The students were given a letter of invitation and a consent form for their parents/guardians, explaining the aims and the importance of the study. Only consenting students were accepted as participants in the study.

Clinical examination

Dental screening was conducted by two trained research assistants (dentists) and by the principal investigator (DST). Calibration exercises were undertaken before the field work started. Data collection was carried out in two phases. During the first phase, the research team mapped all the TDI and controls according to the inclusion criteria (Table 1). In the second phase, a detailed clinical examination of TDI with unmet treatment need cases and their matched controls was conducted by the principal investigator. All clinical examinations were undertaken in the school dental surgery under standardized conditions. For each examination, the examiner wore new gloves and used a sterile set of instruments comprising a plane mouth mirror and a No.9 probe.

In order to adjust for possible confounders, caries experience, periodontal status and aesthetics were recorded (40). Dental caries was recorded at tooth level using the DMFT index as described by WHO Oral Health Surveys (41), where the D (decayed), M (missing) and F (filled) components were recorded separately. Periodontal

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

Trauma category	Criteria
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 neighboring 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) as 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. 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 (22). Cases are defined as category 2, 3, 5 and 7 (bold face).

condition was also assessed in accordance with WHO criteria (41), using the Community Periodontal Index (CPI). Three indicators of periodontal status are used for this assessment: (i) gingival bleeding, (ii) calculus and (iii) periodontal pocketing. For subjects under the age of 20 years, only six teeth 16, 11, 26, 36, 31 and 46 are examined. This is to avoid scoring the deepened sulci around the erupting second molars (teeth 17, 27, 37 and 47) as periodontal pockets (41). Dentofacial aesthetics was assessed using the aesthetic component of the index of orthodontic treatment need (AC-IOTN) (40). This is a ten point scale based on pictures: the appearance of the anterior dentition is ranked from 1 = most attractive to 10 = least attractive (40).

Questionnaire phase

The participants completed a self-administered questionnaire before the clinical examination in the dental surgery. A dental assistant blinded from the aims of the study assisted students facing any difficulties with the questionnaire.

The questionnaire covered such topics as socio-demographic characteristics: age, sex, parental educational level. Education was recorded according to mother's years of education (>12 years of education was considered high, and ≤ 12 years of education was considered low).

To test the questionnaire and clinical assessment, a pilot study was carried out in 10 randomly selected 16–19 year-olds. The interview format was tested and adjusted before the data collection started.

The Oral Impact on Daily Performance (OIDP) was used as a measure of the oral impact of TDI on daily activities of the adolescents. The OIDP inventory consists of eight items (questions) related to daily physical, psychological and social activities over the past 6 months, including: (i) eating and enjoying food, (ii) speaking and enunciating clearly, (iii) cleaning teeth, (iv) sleeping and relaxing, (v) smiling without embarrassment, (vi) maintaining emotional status, (vii) enjoying contact with other people and (viii) carrying out school related tasks (42).

The OIDP-instrument has not previously been applied in an Albanian population and moreover there is no universally accepted 'gold standard' (43). Therefore, before start-up, OIDP was assessed in an equivalent of school students (16–19 years old), following translation and cross-cultural validation from English to Albanian and back. The scale passed the face content validity during this phase.

Cohen's Kappa value for the OIDP ranged from 0.72 for smiling and showing teeth (Question 5) to 0.79 for enjoying contact with people (Question 7). Cronbach's Alpha was used to test the internal consistency of the OIDP scale, giving a standardized item alpha of 0.76, which is considered good. The instrument revealed very good validity and reliability. The results from the validation study will be presented in a forthcoming paper.

Reliability

A sub-sample of 45 students (15%) was re-interviewed and re-examined after 10–14 days for validation purposes (inter- and intra-examiner reliability). The inter-examiner reproducibility test was done between each of the research assistants and the first author; Cohen's Kappa value for agreement between examiners ranged from 0.94 to 1. Intra-examiner reliability of the principal investigator (clinical parameters) ranged from 0.69 for the CPI to 1 for TDI, i.e. from good to excellent agreement (44).

Statistical analysis

Data processing and analysis were carried out using the Statistical Package for Social Sciences (SPSS), version 14.0 and STATA version 10. Frequencies, cross-tabulation chi-square and mean were calculated for different variables. The outcome variable was OIDP. The total OIDP score was constructed in two ways. The eight performance

scores as originally scored (0–4) were added into an OIDP additive score (ranging from 0 to 32). Second, the OIDP simple count score was constructed by summing the dichotomized frequency items of impact and no impact where OIDP = 0 was no impact recorded as 0 and OIDP ≥ 1 (impact) recorded as 1. The cut-off point was set at 'Never or less than once a month' which was considered as having no impact on the OIDP.

Conditional logistic regression analysis for matched data was used to assess the relationship between traumatic dental injuries with treatment need as the main independent variable and OIDP as a dependent variable outcome. Other independent variables were considered in the analyses in order to control for possible confounders with the dichotomizations as follows: CPI = 0 healthy gingiva means no gingival bleeding calculus or periodontal pocketing, CPI ≥ 1 means presence of gingival bleeding, calculus or periodontal pocketing, or combining of them. Mother's educational level >12 years of education was considered high, and ≤12 years of education was considered low. AC-IOTN was dichotomized for use in cross tabulation and logistic regression analysis as 0 (no treatment need, rated 1–4) and 1 (treatment need, rated 5–10). The DMFT was dichotomized into DMFT = 0 (caries free) and DMFT ≥ 1. The level of significance was set at 0.05.

Table 2. Frequency distribution of cases and controls according to gender and age

	Cases, *n* (%)	Controls, *n* (%)
Gender		
Male	66 (69.5)	132 (69.5)
Female	29 (30.5)	58 (30.5)
Age		
16 years	20 (21.1)	40 (21.1)
17 years	44 (46.3)	88 (46.3)
18 years	28 (29.5)	56 (29.5)
19 years	3 (3.2)	6 (3.2)

Table 3. Frequency distribution of relevant variables

	Cases, *n* (%)	Controls, *n* (%)	*P*-value
Mother's education			
Up to 12 years	69 (72.6)	102 (53.7)	0.002
12 years or more	26 (27.4)	88 (46.3)	
CPI status			
CPI = 0	58 (61.1)	131 (68.9)	0.09
CPI ≥ 1	37 (38.9)	59 (31.1)	
AC-IOTN			
1–4	68 (71.6)	144 (75.8)	0.47
5–10	27 (28.4)	46 (24.2)	
DMFT-status			
DMFT = 0	8 (8.4)	27 (14.2)	0.18
DMFT > 0	87 (91.6)	163 (85.8)	

Results

Of the total number of 2964 adolescents invited to participate in the study, 2 903 accepted (98% response rate). Only 99 students were affected by at least one TDI with unmet treatment need. Four of the cases were later excluded from the study due to incomplete data in the questionnaire phase. The matched 8 controls for these four cases were also excluded. This led to a final sample size of 95 cases who completed the questionnaire and underwent a full mouth clinical examination (mean age 17.15 years, 69.5% boys) and 190 controls (mean age 17.15 years, 69.5% boys) (see Table 2).

With respect to dental caries, the mean DMFT for the cases were 5.4 (SD = 3.42). For the control group, the respective values were 4.3 (SD = 3.29). Mothers of the cases had significantly lower educational levels than the mothers of the controls. The frequency distribution for AC-IOTN was similar for cases and controls, with 28.4% and 24.2%, respectively, rated themselves as grade 5–10 (Table 3).

The mean OIDP for the TDI cases was 6.1 (SD = 4.56), and for the control group 3.8 (SD = 4.51). The overall impact prevalence of OIDP among cases was significantly higher (88.4%) than for the controls (58.9%) ($P < 0.001$), see Table 4. The most prevalent impact was 'smiling and showing teeth without embarrassment' which was reported by cases 78.9% and their controls 31.6% ($P < 0.001$). The second most prevalent impact was 'enjoying contact with people' (66.3%) being significantly more prevalent than their controls (23.2%) ($P < 0.001$). A higher proportion of cases reported impact on the item 'eating and enjoying food' (46.3%) as compared to controls (34.2%) ($P < 0.05$). A significant difference between cases (31.6%) and controls (20%) was found also for the item 'maintaining usual emotional status' ($P < 0.05$). Other items of OIDP were not significantly different as shown in Table 4. A multiple conditional logistic regression analyses were undertaken to disclose the effect of TDI with unmet treatment need on the OIDP. All OIDP items separately and the overall OIDP were adjusted for the variables DMFT, AC-IOTN, CPI and mothers education, which were considered as possible confounders. After the adjustment of the results, a statistically significant difference in 'smiling and showing teeth without embarrassment' and 'enjoying contact with people' were observed between cases and controls (Table 4). The odds ratio (OR) for cases related to 'smiling and showing teeth without embarrassment' was 10.9 (CI = 4.5–26.6), and for 'enjoying contact with people', the OR was 6.1 (CI = 3.1–12.1). Finally, for the overall OIDP, there was a significantly greater probability of perceiving an oral impact on daily life among cases then controls, OR = 3.9 (CI = 1.6–9.1), see Table 4.

Discussion

The study sought to determine the impact of TDI with treatment need based on objective signs on the OHR-QoL. For this purpose a well designed case–control study was conducted. The guidelines for case–control studies were considered (45–48) and followed. However, some comments on methodology are warranted. The case group comprised adolescents aged 16–19 years affected by TDI with treatment need based on objective clinical signs, a fairly homogeneous group with respect to dental traumatic injuries. It would be challenging and

Table 4. Odds ratios (unadjusted and adjusted) with the dependent variable: OIDP 0 (no impact) or 1 (at least one impact registered on one of the eight OIDP-items)

	Cases, *n* (%)	Controls, *n* (%)	OR – unadjusted (CI = 95%)	OR – adjusted (CI = 95%)
Eating and enjoying food				
OIDP = 0	51 (53.7)	125 (65.8)	1	1
OIDP ≥ 1	44 (46.3)	65 (34.2)	1.7 (1.01–2.78)*	1.01 (0.6–2.1)
Cleaning your mouth				
OIDP = 0	68 (71.6)	136 (71.6)	1	1
OIDP ≥ 1	27 (28.4)	54 (28.4)	0.3 (0.08–1.2)	0.2 (0.06–1.1)
Speaking				
OIDP = 0	92 (96.8)	173 (91.1)	1	1
OIDP ≥ 1	3 (3.2)	17 (8.9)	1.2 (0.5–1.7)	0.9 (0.5–1.9)
Sleeping and relaxing				
OIDP = 0	77 (81.1)	155 (81.6)	1	1
OIDP ≥ 1	18 (18.9)	35 (18.4)	1.1 (0.6–1.9)	0.8 (0.4–1.6)
Smiling and showing teeth				
OIDP = 0	20 (21.1)	130 (68.4)	1	1
OIDP ≥ 1	75 (78.9)	60 (31.6)	8.4 (4.2–16.5)**	10.9 (4.5–26.6)**
Maintaining usual emotional state				
OIDP = 0	65 (68.4)	152 (80.0)	1	1
OIDP ≥ 1	30 (31.6)	38 (20.0)	1.8 (1.1–3.2) *	1.8 (0.9–3.6)
Carrying out school related tasks				
OIDP = 0	91 (95.8)	168 (88.4)	1	1
OIDP ≥ 1	4 (4.2)	22 (11.6)	0.4 (0.1–1.1)	0.5 (0.1–1.8)
Enjoying contact with people				
OIDP = 0	32 (33.7)	146 (76.8)	1	1
OIDP ≥ 1	63 (66.3)	44 (23.2)	5.6 (3.2–9.8)**	6.1 (3.1–12.1)**
Overall OIDP				
OIDP = 0	11 (11.6)	78 (41.1)	1	1
OIDP ≥ 1	84 (88.4)	112 (58.9)	5 (2.4–10.2)**	3.9 (1.6–9.1)*

*P value < 0.05, **P value < 0.001.

difficult to compose a completely homogeneous group based on each category of the dental traumatic injuries index because of the retrospective nature of the study and the complications and complexity of TDI. The selection of the controls (2:1) by age, gender and sourced from the same class and circle of friends as their respective case is well defined: the controls closely match the cases in all respects other than experience of TDI. The peer group is an essential aspect of adolescent life: within this group adolescents can express, define, and emancipate them selves by being alike and not alone. Characteristic for a peer group is that the members exhibit similar behaviour and tendencies (49, 50).

The data collections took place at school dental surgeries, which contributed to standardized data in case and control groups, and probably have increased the reliability of our results. Nonetheless, even though the six schools were situated in areas reflecting different social economic levels, the participating schools were exceptional and equipped with a functional dental office. Whether this sample also would represent adolescents in Tirana city as such, is not possible to deduce.

Recall bias may be present due to the retrospective nature of the study (45). Cases may have a tendency of overestimate the impacts of OIDP as results of being more informed on the problems caused by TDI and memories related to injuries.

Other confounding bias factors have been taken into account as they may have an impact on quality of life: e.g. dental caries, periodontal diseases, the AC-IOTN, and socio-economic indicators such as mother's level of education. The selection of confounders is based on previous studies (33, 34). However the period when the dental trauma occurred and the number of previous episodes of TDI may have a confounding effect. These factors were not included in the statistical analysis because of the limited number of cases in the material experiencing more than one episode of trauma.

The results show that unmet treatment need after TDI based on objective signs corresponds well with the participants' subjective perception expressed in the form of impact on quality of life.

The survey disclosed that compared to controls, a significantly higher proportion of cases perceived at least one impact on daily living (84.4% vs 58.9%). These findings are supported from other previous (33–35) studies even that this field needs further research. Cortes et al. (33) reported 66.2% of adolescents affected by untreated dental traumatic injuries with at least one impact on OIDP. Factors other than TDI may have influenced the outcome. The case group in this study may reflect more severe TDI than in the study by Cortes et al. (33). In the present study, dental caries status (DMFT) was almost twice as high as in the study by Cortes et al. (33) (5.38 vs 2.8). Analysis of the AC-IOTN discloses that a higher proportion of participants in the present study ranked themselves in category 5–10, indicating a need for treatment: 28.4%, compared to 9% in the study by Cortes et al. (33). The age group is also different, 16–19 years in the present study compared to 12–14 years in the previous

study. Older adolescents are likely to be more concerned about their appearance, which may be linked with the peak age of dating (49–51). This might be reflected in the higher proportion of cases perceiving that TDI had an impact on smiling and showing teeth, and enjoying contact with people (Table 3). The findings were corroborated in other studies that investigated the social impact of untreated TDI on quality of life (33, 35). Other studies had found a significantly higher proportion of children and adolescences affected by untreated TDI had impacts on 'eating and enjoying the food' (33, 35) which was not the case of this study after controlling for possible confounders. Perception of oral health and quality of life is multidimensional and mainly subjective, involving personal and social judgments or values influenced by culture, politics, society and the environment (52). Therefore the diversity in people's perception of the same oral condition is not surprising.

Other studies conducted in Brazil (34) and Canada (35) showed a lower prevalence of OIDP scores and odds ratio than in the study by Cortes et al. (33). However, the cases were children and adolescents affected by TDI who had received dental treatment, affirming that treatment of TDI reduce the impact on OHRQoL (34).

It is concluded that TDI with unmet treatment need in this sample of adolescents is associated with reduced OHRQoL. Compared to adolescents with no history of TDI, those affected by TDI with unmet treatment need are at greater risk of suffering impacts on OHRQoL in the form of OIDP. More effort is needed to address the unmet treatment need among children and adolescents in Tirana, Albania, after experiencing TDI.

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