

Traumatic Dental Injuries among Adolescents In Republic of Moldova

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Objectives: The aim of this investigation was to evaluate the epidemiological data on dental injuries in permanent teeth among seventh and tenth grade schoolchildren in the Republic of Moldova. **Study design:** *The pathfinder study model was chosen to evaluate the prevalence of Traumatic Dental Injuries (TDI). Schoolchildren ages 12 and 15 years old were examined: In the capital city (four schools), in two other major cities—(two schools each city), and in four villages (one per each village) in accordance with the WHO's recommendations.* **Results:** *A total of 720 seventh and tenth grade schoolchildren were examined. The overall prevalence of TDI was found to be 16.4% (total of 118 children). The prevalence of TDI was greater in the older age cohort ($p < 0.05$). Children from rural areas presented with greater prevalence of TDI compared to children who live in urban region ($p < 0.03$). The maxillary central incisors were found to be the most common teeth affected by trauma constituting 57.1% of the evaluated TDI cases. Enamel fracture was the main type of TDI (83%).* **Conclusions:** *The TDI mainly involved enamel fractures. Urban schoolchildren show lower rates of TDI compared to rural schoolchildren.*

Keywords: Traumatic dental injuries, adolescents, Republic of Moldova,

INTRODUCTION

Conducting oral health surveys in different countries on a regular basis has been proven to be an important trend in revealing the global oral health status¹. The World Health Organization's (WHO) Global Oral Health Data Bank collates data that are gathered from country surveys on oral diseases¹. One of the serious widespread public dental health issues is Traumatic Dental Injuries (TDI)^{2,3}.

The prevalence of TDIs in the anterior teeth region among schoolchildren has been studied in different parts of the world by many researchers, and a wide range of variations has been reported⁴. In general one third of all preschool children and one fourth of all school children have suffered trauma to permanent dentition⁵.

As most traumatic dental injuries involve the anterior teeth they may result in dietary restrictions, changes in physical appearance, speech impairments and psychological impacts – all of which may significantly affect the child's quality of life⁶⁻⁸.

In contrast to many other traumatic injuries treated on an outpatient basis, a TDI is mostly irreversible and thus treatment will likely continue for the rest of the patient's life⁹. Children and their parents are highly concerned about the child's facial appearance. The TDI could have significant functional, esthetic, speech, and psychological effects on children thus affecting their quality of life¹⁰. Loss of anterior teeth due to dental injury not only cause a deterioration in the child's oral function but may also make him the target for teasing and even ridicule by other children due to reduced facial and smile esthetics^{6,11}. Furthermore, while health care professionals including dentists concentrate on the trauma

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treatment results they do not raise adequately address the measures available for preventing dental trauma¹².

The treatment of TDIs and their complications also incur a considerable financial burden^{13, 14}. Thus, prevention of dental trauma is a public health priority^{13, 15} and therefore recently we are witnessing increased attention to this issue in the dental profession¹⁶. The information on the prevalence and severity of dental trauma in various age groups of a specific population is a significant factor for planning public dental care strategies in the population¹⁷.

WHO¹ recommends national epidemiology surveys to monitor oral health status of specific age groups. In order to overcome logistic, economic and other barriers, WHO recommends that the focus be on epidemiology surveys of small samples in different regions in the observed countries. The WHO guidelines for national pathfinder surveys are designed to ensure the participation of an adequate number of individuals that may present different disease prevalence of the conditions that are under examination¹. To date no information in regards to this issue could be found for the Republic of Moldova.

The aim of this cross sectional survey was to collect epidemiological data concerning TDI in permanent teeth among 12 and 15 year old schoolchildren in different regions of residency in the Republic of Moldova.

MATERIALS AND METHOD

The Israeli-Moldavian Regional Development Program was conducted from 2015 to 2016 with the support of IADR (International Association of Dental Research). A preliminary workshop program on the principles of performing a pathfinder study and hands-on training on TDI evaluation was conducted in collaboration with the Faculty of Stomatology, State University of Medicine and Pharmacy “Nicolae Testemitanu”, Chisinau, Moldova. This study was executed in full accordance with the World Medical Association Declaration of Helsinki. Informed consent as well as pertinent medical information was received from parents via the schools. The local authorities were responsible for approval of the parents and the ethics committee. It should be noted that the examinations were only visual and offered as a service to the public, without any invasive procedures involved.

This study was planned and performed according to the guidelines of the WHO indicated for pathfinder surveys¹. The inclusion criteria for the study were 7th and 10th grade schoolchildren index age (12 and 15 year-olds). The school classes participating in the survey were randomly chosen at each site. Information on the ideal sampling site was provided by local dental academic staff after consulting with health administrators regarding the distribution of different levels of oral disease.

Sampling sites included four schools in the capital city—Chisinau (four schools), in two other large cities—(two schools in each city), in four villages—(one school in each village), totaling 12 schools.

Clinical examination was performed by dentists and dental students after participating in hands on training workshop. This training aimed to achieve a calibration in diagnosing of TDI. Demonstrative slides with different type of TDI were presented and were scaled according to Sgan-Cohen *et al*² (Fig 1). Thereafter the examiners were presented with unmarked slides and expected to diagnose the correct type of TDI. Later on, a single patient was

Fig 1: Type of TDI – Scaled according to Sgan-Cohen et al. (2).

T 0	no evidence of trauma
T 1	trauma limited to the enamel
T 2	trauma involving dentine
T 3	trauma involving the pulp
T 4	trauma that was treated
T 5	discoloration due to trauma
T 6	avulsed tooth due to trauma

examined and diagnosed by all examiners. The calculated interexaminer reliability score was 93%. TDI clinical examinations were performed by using artificial light and dental mirrors, according to the methodology provided by the WHO.

Demographic data and oral and dental clinical parameters were collected and recorded. The clinical parameters (over-jet, lip posture, number and type/location of the TDI) of only permanent teeth were studied and measured, as previously extensively described in the pathfinder study performed by Bilder *et al*¹⁸.

Data analysis including frequency distributions and cross-tabulations, associations between dental injuries and gender/age were studied using the Student’s t-test. Chi-square analyses were used to assess the relations between categorical data and the prevalence of TDI.

The correlation between TDI and the known confounding variables was examined by means of a Pearson’s correlation co-efficient test. Furthermore, the variables that were found significant (independently) were entered into a multi linear regression analysis to find the best set of variables to predict TDI (StatPlus® Version 5.8.4).

Significance levels were set at $p < 0.05$.

RESULTS

A total of 720 school children were examined in this cross sectional survey. Among them 365 (50.7%) were 12 years old and 355 (49.3%) were 15 years old where 369 (51.2%) were boys and 351 (48.8%) were girls (Table 1). Among the total population 490 (68%) of the school children lived in urban areas (220 lived in the capital city and 270 lived in the two other cities) and 230 (32%) lived in rural regions. An incisal over-jet greater than 5 mm was observed in 23 (3.2%) of the children while incompetent lip postures were found in 36 (5%) of the children (Table 1).

The overall prevalence of TDI among the Moldavian population in the two age groups (12 and 15- years old) was 16.4% (118 schoolchildren). 27.1% of them (32 schoolchildren) were presented with more than one tooth injured. No significant difference was found concerning gender ($p>0.5$) among the 118 children diagnosed with TDI. The prevalence was significantly higher among the 15 year old school children, compared to the 12 year old school children ($p<0.05$) (Table 2). In this investigation we found a correlation between OJ and lip posture ($p=0.000$), where the percentage of children with competent lips decreased with an increase in OJ. No difference was recorded between 12 and 15 year old children regarding the amount of OJ ($OJ>5$) and lip posture (competent/incompetent lips). Lip posture did not markedly affect TDI. The prevalence of

TDI in children with incompetent lips was not significantly different from that found in participants with competent lips (Table 2). An increased over-jet dimension equal to or greater than 5 mm was more predisposed to present with dental injuries compared to children with an over-jet smaller than 5mm. These results however bordered on but did not exceed statistically significant differences (p=0.073; see Table 2).

A significant difference of TDI was recorded regarding the sampling population's location. Children from rural areas presented higher prevalence of TDI compared to their urban counterparts (p<0.03; Table 2). From the 177 teeth affected by trauma the majority of TDI were recorded in the maxilla (81.9%) while only 18.1% were mandibular teeth. Maxillary central incisors were the most vulnerable teeth constituting 57.1% of the TDI cases. Maxillary lateral incisors were the second most common teeth involved (29%).

The distribution of the dental trauma type was as follows: The main type of TDI (of the 177 injured teeth) was T1–enamel fractures–147 teeth (83%), 25 teeth (14%) were at the T2 level, 1 tooth (0.6%) was grade T3, 2 teeth (1.2%) were grade T4, 1 tooth (0.6%) was grade T5 and 1 tooth (0.6%) was grade T6.

A multi-variant regression revealed a statistically significant relationship between the prevalence of TDI and age (p<0.03), and the prevalence of TDI and the region of residency (capital city\non capital city and villages) (p<0.01; Table 3).

Table 1: Descriptive data (N=720).

Variables	Participants N (%)	
Age Year-old N (percentiles)	12: 15	365 : 355 (51:49)
Gender N (percentiles)	F : M	351 : 369 (49 : 51)
Lips posture N (percentiles)	Competent : Incompetent	687 : 33 (95:5)
Over Jet N (percentiles)	OJ < 5mm : OJ ≥5mm	698 : 22 (97:3)
Habitation N (percentiles)	Urban:Rural	490 : 230 (68:32)

Table 2: Variables associated with presence of at least one tooth with TDI

Categories	Groups	N (%)*	p- value**
Gender	Females	58 (16.5)	0.924
	Males	60 (16.3)	
Age	12 year-old	50 (13.7)	0.049
	15 year-old	68 (19.2)	
Habitation	Urban	70 (14.3)	0.027
	Rural	48 (20.9)	
Lips posture	Competent	113 (16.4)	0.844
	Incompetent	5 (15.2)	
Over-jet	<5 mm	112(16%)	0.07
	≥5 mm	6(27.5%)	

* Percent of total population

** Chi-square test

Table 3: Multi-variant regression for effect of independent variables on the prevalence of TDI

		B	P val.	Adjusted OR	95% C.I. for OR Lower	Upper
Habitation	Non capital cities & villages vs. capital city	.990	0.000	2.69	1.60	4.54
AGE	15 vs.12	.449	0.029	1.57	1.05	2.35

DISCUSSION

This study was performed on the Moldavian population in order to evaluate the prevalence of TDI. According to a preliminary literature survey and to the best of our knowledge no study has yet been published on the prevalence of TDI among the Moldavian population. In the present study, 16.4% of Moldavian 12 and 15 year-old age school-children presented with at least one tooth involved in TDI. In a previous pathfinder study carried out by Bilder *et al*¹⁸ in the Republic of Georgia 10.4% of Georgian 12 and 15 year-old age schoolchildren presented with at least one tooth with TDI. The spectrum of the TDI according to scientific papers over the last 5 year period is wide. A lower rate of TDI of 5.5% was observed in Jordanian youth¹⁹. In Kashmir, India a rate of 9.3% of TDI was reported⁴ and Blokland *et al*²⁰ reported a 9% rate of TDI. However recently published investigations reported a higher prevalence of TDI, with findings of 15.2 %²¹, 17.3%²²and 17 %²³. The wide variation reported in TDI prevalence may reflect the differences in the study population, the age variation of the participants, the variation of examination methods, the type of dentition and the TDI classification method that was used¹⁸. Thus, a higher prevalence of TDI was reported among children in lower socio-economic groups compared to higher ones²⁴. Gender differences were related to the fact that boys are more active and therefore are prone to dental trauma²⁵. The significant proportion of TDIs in young children could be explain by physical leisure activities at home, in kindergartens, at playgrounds and in schools²⁶ while teenagers, on the other hand, are mostly injured during sport activities, traffic accidents and some forms of violence²⁷. Differences in investigations' methodology may include the type of dentition and the TDI classification method that was used. In the present study TDI was measured for six upper and lower frontal teeth whereas in other investigations TDI were recorded in the incisors only¹⁹ or for untreated TDI²². Therefore, in these studies underestimated TDI is expected compresence to methodology of the investigation.

In the current study, the prevalence of TDI among 15 year old schoolchildren (19.2%) was higher than that found in 12 year old schoolchildren (13.7%). This is in accordance with the findings reported by Thelen and Bårdsen²⁸. They reported a TDI prevalence in the incisors ranging from 8.9% in 16-year-olds to 10.5% in 18-year-olds. However, the cumulative nature of absolute TDI would always support an increase in the percentiles with age²⁹. Thus, the number

of new TDI per year or incident rate reflects the effect of the age on this phenomenon²⁹.

Moldavian schoolchildren with OJ > 5 mm exhibited greater TDI (27.6%) compared to their peers with smaller OJ (16.1%) $p=0.073$. These results were bordered on but did not exceed statistically significant differences. An increased overjet was found to be associated with an increase in the severity of tooth fractures^{2, 17, 19, 22, 30}. Different studies applied different OJ thresholds: Sgan-Cohen *et al*² and Livny *et al*³¹ used an incisal over-jet threshold larger than 4mm and 5 mm while Gupta *et al*¹⁷ and Goettems *et al*³² used 3 mm for their cut-off. Consequently, these different thresholds affect the differences in the reported results.

The most important variable predicting TDI is considered incisors' overjet. Large anterior overjet in primary and permanent dentition is partly responsible for 100–300 million TDIs globally³³. Statistically, lip competence/incompetence is an important confounder for overjet⁵. However, in many studies which used large overjet threshold levels, lip competence could not be properly correlated because the majority of subjects with enlarged overjet concurrently show lip incompetence and vice versa³³. Thus, largest overjet and lip incompetence are co-linear variables³³. This might be the reason for several studies to conclude no effect of incompetent lips at rest on the prevalence of dental injury³⁴. Lip posture results in the present study, did not seem to present a major effect on TDI with an overall prevalence of 15.2% and 16.4% for competent and incompetent lips, respectively ($p=0.844$). Conversely, Gupta *et al*¹⁷ reported that children with inadequate lip coverage had 3.4 times greater risk for TDI than children with adequate lip coverage. Similar findings were described by Sgan-Cohen *et al*² and Livny *et al*³¹. While Piovesan *et al*³⁵ initially found a weak association between lip coverage and TDI, they reported that after making adjustments for confounding variables, they could not find any statistical significance between the two. According to the previous pathfinder study among Georgian schoolchildren, no correlation was found between incompetent lip posture and TDI¹⁸.

Rural schoolchildren, according to our findings, presented with significantly ($p=0.027$) greater TDI (20.9%) compared to city dwellers (14.3%). These conclusions are supported by other investigations, as TDI among rural Georgian schoolchildren (14.8%) was found to be greater than in the urban schoolchildren population (8.6%)¹⁸. Rural children were found at higher risk of overall injury compresence to urban children³⁶. This may be explained by the fact that rural population has migrated to work in cities (migrant

workers), leaving their children in their hometowns. These 'left-behind children', have not received enough care and adult supervision, nor appropriate education about injury prevention. Therefore, they are prone to a dangerous environment for injuries to occur³⁷. In the Republic of Moldova nearly half (44 percent) of households with a member living abroad were caring for at least one child left behind. This proportion was found to be higher in rural than in urban areas³⁸. Additionally, according to Sharva *et al*³⁹ the higher TDI among rural schoolchildren can be explained by their prone to vigorous activities compared to restricted behavior reported for urban children. Conservative parents in urban population enforced children restricted behavior due to cultural and social conditions⁴². Furthermore, poverty is a predominantly rural phenomenon, as it is four times higher than in urban areas⁴⁰. This fact relates to the finding of Hamilton *et al*⁴¹ and Marcenes and Murray⁴², that the major environmental determinant of TDIs is material deprivation.

Prevention programs are an effective method for reducing TDI incidence^{16, 32, 43}. The programs may be directed towards high-risk populations^{35, 43} and health care professionals¹⁶. Emphasis should be on primary prevention, i.e. avoidance of pathological development, and/or secondary prevention, i.e. early diagnosis and treatment of the pathology before significant morbidity occurs¹⁸.

Since the less privileged groups have a higher risk of TDI and accidents in the school playground frequently occur at school, this may have implications for the public health system as well as the education authorities. There is evidence that health promoting schools, which have a more comprehensive curriculum and commitment towards health and safety, have significantly lower levels of TDI⁴⁴. The general conclusion of international studies dealing with TDI is that school staff have little knowledge related to prevention and handling of TDI^{45, 46}. Our findings may serve as a preliminary report regarding the need of adequate contemporary prevention programs aimed to improve the knowledge of school staff for preventing TDI.

CONCLUSIONS

The prevalence of TDI in Moldavian schoolchildren was found to be high and involve mainly enamel fractures. Urban schoolchildren in this report demonstrated lower rates of TDI. Consequently, the educational program should directed more toward the children, teachers and health care providers in rural regions. The retrieved epidemiology data should be presented to the local and national public and political leaders in order to monitor and improve this public health problem.

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