

# Traumatic dental injuries in children with special health care needs

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## Abstract

**Background/Aim:** Children with special healthcare needs (CSHCN) are at an increased risk for traumatic dental injuries (TDI) due to unique predisposing factors; moreover, their access to dental care is compromised. In Jordan, there is a need to study TDI among CSHCN to highlight their dental care needs. The aim of this study was to identify the prevalence, types, possible risk factors associated with TDI, and treatment-seeking behavior in CSHCN in Jordan.

**Material and Methods:** Children (n=959) were examined in schools/centers for CSHCN, and compared to a healthy age- and gender-matched control group. Data concerning demographics, types of trauma, risk factors associated with TDI, and treatment-seeking behavior were collected. Data were analyzed using SPSS for descriptive and bivariate analyzes. Significance level was set at  $P \leq .05$ .

**Results:** Prevalence of TDI in the study group (age,  $11.76 \pm 4.2$  years) and control group (age  $11.70 \pm 4.2$  years) was (83 of 959, 8.7%) and (42 of 1010, 4.1%), respectively. TDI prevalence was highest in children with multiple disabilities (14.0%), followed by intellectual disabilities (13.1%), and cerebral palsy (12.2%). The most common type of TDI was an uncomplicated crown fracture (91.0%). Increased overjet and incompetent lips were significant risk factors associated with TDI. Reasons for not seeking treatment in the study vs control group included parental attitude and lack of dental awareness (68.1% vs 60%), difficulties getting an appointment and availability of dental clinics willing to see CSHCN (36.2% vs 0%),  $P \leq .01$ , and financial reasons (31.9% vs 40%).

**Conclusions:** Prevalence of TDI was higher in CSHCN, and associated with increased overjet and incompetent lips. Uncomplicated crown fracture was the most common injury. In both groups, the main reason for not seeking treatment was lack of dental awareness among parents/caregivers; however, difficulties in getting an appointment and availability of dental clinics willing to see children were more prominent in the CSHCN group.

## KEYWORDS

children, special healthcare needs, traumatic dental injuries, treatment

## 1 | INTRODUCTION

Special health care needs are defined by the American Academy of Pediatric Dentistry (AAPD) as "any physical, developmental, mental, sensory, behavioral, cognitive, or emotional impairment or limiting condition that requires medical management, healthcare intervention,

and/or use of specialized services or programs".<sup>1</sup> This definition is congruent with the definition of the Higher Council for Affairs of Persons with Disabilities (HCD) in Jordan.<sup>2</sup>

In the Hashemite Kingdom of Jordan, during 2010, there were 819 000 persons with disabilities of the total population of 6.5 million (12.6%).<sup>3</sup> The most recent national statistics from the HCD indicated

that there were 40 259 Jordanian children with special healthcare needs (CSHCN), aged 0-18 years, who were diagnosed between the year 1990 and 2009.<sup>2</sup> These individuals are at higher risk for traumatic dental injuries (TDI), which may be related to the nature of the medical condition and factors such as neurological, intellectual, behavioral, and physical impairments.<sup>4</sup> In addition, injuries may be related to the side effects of medications they are taking.<sup>4-6</sup>

Previous studies of TDI in CSHCN have concentrated on individual types of medical diagnosis, such as cerebral palsy, autism, and attention deficit hyperactivity disorder (ADHD), with regard to the prevalence of TDI, types, causes, or seeking treatment behavior in children.<sup>6-14</sup> While there are limited studies regarding TDI among a diverse sample of CSHCN, a recent report regarding a population of more than 500 CSHCN in Brazil indicated that 9.2% had TDI. The majority (78.3%) of these individuals sought dental treatment for the first time at a later age.<sup>15</sup> Another study in India reported a prevalence of TDI in 12.1% of CSHCN compared with 6.9% in the control group.<sup>16</sup> In Jordan, CSHCN have not received significant attention by researchers, and there is a clear need to study TDI among CSHCN in order to highlight their dental care needs. Therefore, the objective of this study was to identify the prevalence, types, and possible risk factors associated with TDI, as well as the factors related to treatment-seeking behavior in this population of children.

## 2 | MATERIAL AND METHODS

### 2.1 | Ethical approval

Approval for the study was obtained from the Institutional Review Board (IRB) of Jordan University of Science and Technology (IRB#5/2012). Proper permissions were also obtained from the Ministry of Social Development and Ministry of Education, Jordan. Written consent was obtained from the children's parents/legal guardians for their children to participate.

### 2.2 | Sample selection

This cross-sectional study included a cluster random sample from the northern and middle provinces of the Hashemite Kingdom of Jordan (Irbid and Amman governorates). A power calculation was used to determine the minimum sample size required to establish significance. Using a prevalence figure of 12.1%,<sup>16</sup> setting the confidence level at 95%, and using a margin of error of 5%, the minimum required sample was 395. However, the sample size was increased to account for contingencies, such as non-response, inability to examine due to limited co-operation, or respondent's recording error. Therefore, the number of children targeted in the study was 1010 to ensure powerful results. Recruiting the study participants was carried out in multiple steps. The first stage was to obtain a list of all schools and centers for CSHCN from the Jordanian HCD. There were 158 schools/centers in these two regions. A random selection of 25% of schools/centers was carried out using random tables. Forty schools/centers were contacted

to participate in the study by phone, fax or e-mail, and 30 schools/centers agreed to participate.

The second stage of sampling was to select 25% of the eligible students in each facility. Inclusion criteria included children between 3 and 18 years old who had at least one or more of the following conditions: cerebral palsy; Down's syndrome; neurobehavioral disorders such as autism spectrum disorder (ASD) and ADHD; intellectual disability; motor difficulties; learning difficulties; severe to profound visual and hearing impairment (that impact an individuals' ability to successfully complete everyday life activities); and other disabilities. Patients with more than one medical condition were categorized as having multiple disabilities. Exclusion criteria included limited co-operation during examination. Invitations for participation in the study were sent out to the parents/legal guardians. After consent was obtained, the medical records were reviewed to determine eligibility based on the diagnosis provided by the child's physician; ultimately, 1010 children were included in the study.

The study population was matched for age and gender with 1010 control healthy children. The control population was selected randomly from the public schools and preschools from a list provided by the Ministry of Education. Selected students were given copies of consent forms to be signed by their parents or legal guardians. Only those with written consent and a non-relevant medical history (as confirmed by the parents and the school nurse) were included in the study.

A standard examination form was used for data collection by the investigator, and a questionnaire (Figure 1) was used to collect history and treatment details about current and previous trauma in CSHCN from the parents or caregiver. The questionnaire was verified by five faculty members at Jordan University of Science and Technology (JUST) to confirm clarity and simplicity, and then was piloted on 20 parents attending the pediatric dentistry clinics at JUST. Demographic data and medical history were obtained from the children's medical records and verified by the study investigator during the examination. A trauma-related examination was performed after prophylaxis using a toothbrush and toothpaste for each participant. The following demographic, health, and trauma details were included:

- I Child's demographic data (age, gender, medical diagnosis/condition) obtained from medical records.
- II Trauma details as recalled by parents/caregivers (obtained from questionnaire) regarding:
  - a. History of current and previous TDI: including place and cause
  - b. Treatment sought for TDI:
    - i. If treatment was sought, the parent was asked to indicate the type of treatment received. The respondent was instructed to select all applicable treatments:
      1. Pharmacological: prescription of pain killers, antibiotics, and tetanus injections.
      2. Dental: restorative, endodontic, surgical, prosthetic, and splinting.
    - ii. If treatment was not sought, the parent was asked to select one or more of the reasons for this, including the following:

**Parent/Caregiver Questionnaire Regarding Traumatic Dental Injuries in Children with Special Health Care Needs**

Please fill out the following questions regarding the most recent traumatic dental injuries to your child attending ..... school; and return it back to the school:

**Demographics:**  
 Name: ..... DOB: ..... Sex: .....

**Does your child have any medical problems?**

- No
- Yes, please explain: .....

**History of Traumatic Dental Injuries:**

1) Did your child have any previous injury/injuries to his/her teeth, mouth or face?

- No. No need to complete the questionnaire, thank you.
- Yes. Please proceed to the next questions.

2) Where did the injury occur?

House     School     Street     Playground     Other

3) How did the injury occur?

- Fall on the ground
- Hit with something hard
- Fight
- Road traffic accident, was a seat belt put on?     No     Yes
- During sport, were any preventive measures used such as a mouth guard?     No     Yes
- Other
- Could not remember .....

4) Was your child seen by a dentist after the injury?

- Yes, please answer question 5 only
- No, please answer question 6 only

5) Please indicate what treatment was provided by the dentist (check all that apply):

- Examination only.
- Prescription of medications:
  - No
  - Yes:    Painkillers        Antibiotics        Tetanus vaccine
- Date of last tetanus vaccine immunization: ...../...../.....
- Provision of dental treatment:
  - Adhesive restorations
  - Root canal treatment
  - Surgical (Extraction)
  - Splinting
  - Prosthetic (Removable denture/plate)
  - Others (please explain): .....

6) What was the main reason your child was not seen by a dentist after the injury? (Please check all that apply):

- I couldn't find transportation
- I don't have health insurance that includes dental treatment
- The dental clinic did not accept my insurance
- I didn't think a dentist could help
- I couldn't wait for the dental clinic appointment for too long to have my child seen
- I didn't know where to go
- It did not think it was a big problem that needs a dentist
- I couldn't find a dental clinic that was willing to see my child
- Others (please explain): .....

**FIGURE 1** Parent/caregiver questionnaire regarding traumatic dental injuries in children with special healthcare needs

1. Financial: transportation, dental insurance coverage, and acceptance of insurance by dentist.
  2. Parental attitude: lack of trust in dentists, inability to wait for appointment, lack of dental awareness such as not knowing where to go, or the belief that the trauma was not worth seeking treatment.
  3. Difficulties in getting an appointment: availability of dental clinics that were willing to see the children.
- III The clinical examination consisted of:
- a. The presence/absence of TDI determined by direct clinical examination. When trauma was present, any TDIs were recorded according to the Andreasen classification (1994) as follows:
    - i. Injuries to the hard dental tissues and the pulp: uncomplicated crown fractures and complicated crown fractures.
    - ii. Injuries to the periodontal/supporting tissues: concussion, subluxation, lateral luxation, intrusive luxation, extrusion, and avulsion.
  - b. Condition of the injured tooth: mobility, tenderness to percussion, and discoloration of traumatized teeth.
  - c. Possible associated risk factors with TDI: overjet, overbite, lip competence, anterior crowding.

The children were examined using an intraoral mirror and a Goldman-Fox periodontal probe to measure the overjet and overbite. Overjet was measured as the amount of extension of the incisal edges of upper

incisors labially beyond the incisal edges of the lower incisors when the jaws are closed normally. Overbite was measured as the amount of overlap of the incisal edges of the upper anterior teeth, and the incisal edges of the lower teeth when the jaws are closed.

The examination was performed in classrooms with natural day light. Participants were seated on an ordinary chair in the presence of the caregiver from the school/center staff who helped with children's behavior for an optimal examination conditions.

All examinations were carried out by a single calibrated examiner, and data were recorded by a calibrated assistant (both were pediatric dentistry residents). The examiner was trained and calibrated by a consultant in pediatric dentistry by examining 20 patients aged 3-18 years. There was 98.4% agreement between the two examiners. Intraexaminer reproducibility was measured by re-examination of 20 randomly selected CSHCN participating in the study with a 1-week interval between both examinations. The *k* value of intraexaminer reliability was calculated to be 0.99.

## 2.3 | Statistical analyzes

Data entry and statistical analysis were carried out using Statistical Package for the Social Sciences (SPSS version 20.0) for windows (SPSS Inc., Chicago, USA). Descriptive statistics were used to report the variables of interest in the study. Bivariate analyzes were performed to evaluate the factors associated with traumatic dental injuries among

**TABLE 1** Demographics of study children by medical condition and gender

Medical condition (Study group)	Gender		Total and proportional distribution	Mean Age (years)
	Male	Female		
Cerebral palsy	45 (54.9%)	37 (45.1%)	82 (8.6%)	11.46±3.71
Down's syndrome	92 (55.4%)	74 (44.6%)	166 (17.3%)	11.10±3.83
Neurobehavioral disorders (ASD/ADHD)	106 (84.8%)	19 (15.2%)	125 (13.0%)	9.75±4.22
Intellectual disability	126 (66.0%)	64 (34%)	190 (19.8%)	12.78±3.62
Motor difficulties	11 (69.0%)	5 (31.0%)	16 (1.7%)	11.06±3.23
Learning & speech difficulties	19 (51.4%)	18 (48.6%)	37 (3.9%)	13.50±3.83
Visual impairment	52 (62.7%)	31 (37.3%)	83 (8.6%)	7.54±2.25
Hearing impairment	84 (51.5%)	79 (48.5%)	163 (17.0%)	15.39±2.84
Multiple disabilities	53 (57.0%)	40 (43.0%)	93 (9.7%)	10.84±3.97
Others (Developmental Delay & Epilepsy)	0 (0%)	4 (100%)	4 (0.4%)	11.75±3.89
Total				
Study group	588 (61.3%)	371 (38.7%)	959 (100%)	11.76±4.22
Control group	634 (62.7%)	376 (37.2%)	1010 (100%)	11.70±4.22

CSHCN. The standard Chi-square test was used to assess bivariate relationships with significance level set at  $P \leq 0.05$ .

### 3 | RESULTS

Questionnaires and invitations for the study were sent to 1957 children attending schools/centers for CSHCN. The signed consent forms and questionnaires were returned by 1010 children (51% response rate). Fifty-one children were excluded from the study due to behavioral difficulties that prevented complete optimal oral assessment. This resulted in a total study sample of 959 subjects (mean age  $11.8 \pm 4.2$  years) and there were 1010 matched age and gender healthy children in the control group. The highest proportions of CSHCN in the study group were those with intellectual disability (19.8%) and Down's syndrome (17.3%), followed by children with hearing impairment (17.0%). The demographics of the study children by medical diagnosis, gender, and age are presented in Table 1.

The prevalence of dental trauma in the study and control groups was 8.7% and 4.1%, respectively (Table 2). The difference between the two groups was statistically significant ( $P < .001$ ). Dental trauma was most common in children with multiple disabilities (14.0%), followed by intellectual disabilities (13.1%) and children with cerebral palsy (12.2%). Males were more affected by TDI than females in both groups, the mean ages of the children affected by TDI in the study and control groups were  $11.7 \pm 4.4$  and  $12.0 \pm 3.5$ , respectively.

Most of these injuries occurred at home in both the study and control groups (68.1% and 46.2%), and they were mainly caused by falling over (48.6% and 69.2%).

Of those who reported previous TDI in the study group ( $n=83$ ), 40 had received only pharmacological treatment (40/83, 48.2%), with painkillers being the most common drugs taken (54.4%). Dental

treatment was received by 23 children (27.7%): Extraction was the most common dental treatment (14.5%), followed by adhesive restorations (8.7%). For those who did not seek treatment (47/83, 56.7%), the most common reasons were poor parental attitude and lack of dental awareness (68.1%), followed by difficulties getting an appointment and availability of dental clinics willing to see their children (36.2%), or financial reasons (31.9%).

In the control group, of those with previous TDI ( $n=42$ ), 25 received only pharmacological treatment (59.5%), all in the form of painkillers (100%). Dental treatment was received by 35 children (83.3%); adhesive restorations were the most common dental treatment (70%), followed by endodontic treatment (30%). For those who did not seek treatment (47/83, 56.7%), the most common causes were poor parental attitude and lack of dental awareness (60%), and financial reasons (40%). Significant differences between the two groups were detected regarding the type of dental treatment received and the availability of dental clinics willing to see their children ( $P \leq .01$ ).

Among injuries to the hard dental tissues and the pulp, uncomplicated crown fractures were the most common type of TDI in the study group (91%) and the control group (90.3%). The most commonly injured tooth was the permanent maxillary central incisor in both groups. The prevalence of luxation injuries was statistically significantly higher in the study group (26%) than in the control group (2%), ( $P < .001$ ). There were 75 children in the primary dentition stage; only two had TDI upon examination—one had an uncomplicated crown fracture, and the other had a luxation injury. Table 3 shows the frequency distribution of the types of TDI in the study and control groups (the primary dentition injuries are not presented within this table).

Of all examined injured teeth in CSHCN, 10 teeth were mobile (1.0%), one tooth was tender to percussion (0.1%), and none of the teeth were discolored. However, in the control group, only one tooth was mobile (0.1%), none were tender to percussion, and one was discolored (0.1%).

**TABLE 2** Trauma prevalence based on examination of the study and control groups by medical condition and gender. (Note: Numbers represent the number of CSHCN who suffered trauma per total number of CSHCN in the respective disability category)

Medical condition (Study group)	Total prevalence N (%)	P-value	Prevalence by Gender	
			Male N (%)	Female N (%)
Cerebral palsy	10/82 (12.2%)	0.22	5 (50%)	5 (50%)
Down's syndrome	12/166 (7.2%)	0.54	8 (66.7%)	4 (33.3%)
Neurobehavioral disorders (ASD/ADHD)	12/125 (9.6%)	0.86	11 (91.7%)	1 (8.3%)
Intellectual disability*	25/191 (13.1%)	0.015	19 (76%)	6 (24%)
Motor difficulties	0/16 (0%)	1.0	0 (0%)	0 (0%)
Learning & speech difficulties	3/37 (8.1%)	0.73	3 (100%)	0 (0%)
Visual impairment*	1/83 (1.2%)	0.01	1 (100%)	0 (0%)
Hearing impairment*	7/163 (4.3%)	0.03	3 (42.9%)	4 (57.1%)
Multiple disabilities	13/93 (14%)	0.055	10 (76.9%)	3 (23.1%)
Others (Developmental Delay & Epilepsy)	0/4 (0%)	1.0	0 (0%)	0 (0%)
Total				
Study group**	83/959 (8.7%)		60 (72.3%)	23 (27.7%)
Control group**	42/1010 (4.1%)		31 (73.8%)	11 (26.2%)

\* $P < .05$

\*\* $P < .001$

**TABLE 3** Frequency distribution of types of TDI in study and control groups by tooth

Types of traumatic dental injuries	Study group N (%)	Control group N (%)
Crown fracture by tooth*		
Infraction	9 (5.8%)	1 (1.4%)
Enamel	83 (53.2%)	40 (55.6%)
Enamel-dentin	50 (32.0%)	24 (33.3%)
Enamel-dentin-pulp	14 (9.0%)	7 (9.7%)
Total	156 (100%)	72 (100%)
Luxation by tooth		
Concussion/Subluxation	3 (11.5%)	1 (50%)
Lateral luxation	19 (73%)	0
Intrusive luxation	3 (11.5%)	0
Extrusive luxation	0	0
Avulsion	1 (3.8%)	1 (50%)
Total*	26 (100%)	2 (100%)

\* $P\text{-value} \leq .001$

Both increased overjet and incompetent lips were statistically significantly associated with increased prevalence of TDI in the both groups ( $P \leq .05$ ).

## 4 | DISCUSSION

This study investigated TDI in a large sample of several types of CSHCN and compared the results to a control group. The significantly higher prevalence of TDI in the study group (8.7%) compared

to the control group (4.1%) may be related to several predisposing factors among CSHCN including: limited motor coordination, intellectual disabilities, involuntary physical movement, oral pathological reflexes, spasticity in masticatory muscles, slower responses to surrounding obstacles,<sup>7,9-11</sup> hyperactivity as in ADHD,<sup>6,8</sup> lack of coordination and sensation of the surroundings (visual and hearing impairment),<sup>17,18</sup> or changes in behavior and social interaction (ASD).<sup>4</sup>

The current study found a comparable prevalence of TDI among different medical conditions similar to those in previous studies (6.2-20%).<sup>15,16</sup> Correlations between TDI and the medical condition showed that there was a statistically significant relationship between TDI and intellectual disabilities as well as visual and hearing impairments. Patients with multiple disabilities showed an increased tendency with a marginally statistically significant relationship ( $P = .055$ ) (Table 2). It is important to note that multiple disabilities were usually Down's syndrome, cerebral palsy, and ADHD.

Children with sensory impairments were found to have a lower prevalence of trauma compared to what is reported in the literature. The current study reported a lower prevalence of TDI among children with visual impairment (1.2%) compared to other (9.0%-32.5%) reports in the literature. The same applies to children with hearing impairment who showed a lower prevalence (4.3%) compared to the 10.5%-12.5% reported in the literature.<sup>15-19</sup> Such differences may be attributed to variations in definitions of visual and hearing impairments among different studies. In addition to schools/centers for CSHCN, children with mild visual and hearing impairments usually attend regular schools, which may have made the current study sample not representative of these disability categories. The use of necessary visual and hearing aids is covered by public medical insurance and is a common practice

in Jordan, which might have contributed to the lower TDI prevalence in CSHCN.

The prevalence of TDI as recalled by parents/caregivers in the study group was lower than the actual trauma that was apparent upon examination. This may be due to recollection failure of past events and differences among parents since the trauma occurred in the past which resulted in some events not being recalled. This may also be due to the lower communicative ability of some CSHCN.<sup>20</sup> Most of these injuries occurred at home and were caused by falls, suggesting the need for more educational programs to increase the awareness of parents/caregivers regarding TDI prevention.

In agreement with the published literature, uncomplicated crown fractures were the most common type of TDI in the study (91%) and control groups (90.3%),<sup>6,7,9-11,14,16-18</sup> and the most commonly affected tooth in both groups was the maxillary permanent central incisor.<sup>6,10,11,14,16,17</sup> This can be expected due to their forward position in the upper jaw.<sup>17</sup>

The current study showed that subjects with an overjet of more than 3 mm had a statistically significantly higher prevalence of TDI ( $P=.005$ ). In addition, lip incompetence significantly increased the risk of TDI ( $P=.009$ ). Generally, increased overjet with protruded upper anterior teeth has been reported to be the most important risk factor associated with TDI.<sup>21,22</sup>

Regarding the treatment sought, only 27.7% of the study group had previously sought treatment for TDI. The results were consistent with the literature regarding possible reasons for undertreatment of TDI in CSHCN. The most cited reasons were challenges in treating children with CSHCN in the outpatient clinic setting, lack of treatment sought by caregivers, dependence of these individuals on parents/caregivers to accompany them to appointments, problems in transportation, negative thoughts about dentistry (such as fear and resistance because of previous painful experiences), and the high cost of dental treatment.<sup>7,9,10,15,16</sup> This indicates the need to further investigate the varying barriers to dental care in CSHCN, including economics, numbers of trained and willing practitioners, parent and caregiver awareness, problems in transportation, and negative thoughts related to oral health care. Most important is the need for additional education for parents of CSHCN about the importance of prevention and early treatment of TDI.

This study was subject to the inherent limitations of survey studies that rely on self-reported data collection or data provided by parents/caregivers. Additionally, the late presentation/examination might have masked the true prevalence of minor TDI (eg, concussion).

In conclusion, a higher prevalence of TDI was found in CSHCN especially in children with multiple disabilities, followed by intellectual disabilities, and children with cerebral palsy. The prevailing undertreatment received by CSHCN was mainly due to difficulties in getting an appointment and unwillingness of dental clinics to see these children. This illustrates a need to develop preventive programs to educate parents/caregivers on the importance of managing TDI and to try to implement health policies that encourage dentists in Jordan to accept to treat CSHCN.

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## CONFLICT OF INTEREST

The authors declare that there are no conflict of interests.

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