# Traumatic injuries to the teeth in young individuals with cerebral palsy

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Abstract – The purpose of the study was to assess the characteristics of dental trauma in individuals with cerebral palsy (CP). The study group consisted of 68 individuals (36 boys and 32 girls) who visit daily a school dedicated for children with CP. Their age ranged between 7 and 21 years with a mean age of 12.6 years. The majority (74%) required a wheel chair for mobility, 13% used a walker and the others were able to walk with crutches or without aid. The parents were asked to complete a questionnaire regarding their child's age, gender, medical history, and history of dental trauma. The teeth were evaluated clinically for evidences of past injuries to the teeth, enamel defects in the permanent incisors, scars on the chin and size of overjet. Thirty-nine individuals (57%) had signs of trauma to the permanent teeth. Sixty-eight teeth, mostly the maxillary central incisors, were injured. Boys were slightly less affected than girls, 56% (20/36) and 59% (19/32), respectively. Fracture of enamel and dentine was the most common type of injury (62%). Scars on the chin were detected in 28% of the individuals but only one had fractures of the molar (primary) teeth. The overjet ranged between -3.0 and +14 mm but no correlation could be found between the size of the overjet and tendency to injure the teeth. Localized enamel defects were detected on the labial surface of 13 teeth in nine individuals, probably due to luxation injuries to the primary incisors. The prevalence of dental injuries in a group of individuals with CP was found to be much higher than that of healthy populations despite the fact that CP individuals do not take part in violent sport activities as healthy children do. This should alert caregivers to carry out a profound investigation of the events that result in dental injuries in disabled individuals and suggest methods to reduce this type of morbidity.

Numerous surveys have been published in the dental literature reporting on the incidence and prevalence of traumatic injuries to the teeth (1–5). Foresberg and Tedestam (3) examined 1635 children between the ages of 7 and 15 and found that 18% of them had experienced dental trauma to their permanent teeth. Andreasen and Ravn (2) found 22% injuries to permanent teeth of 9–17-year-old Danish school children. While the

## Gideon Holan, Benjamin Peretz, Jacob Efrat, Yossi Shapira

Department of Pediatric Dentistry, Faculty of Dental Medicine, The Hebrew University – Hadassah School of Dental Medicine, Jerusalem, Israel



prevalence of the various findings may differ from one survey to the other, there are characteristic findings that are repeatedly mentioned in these reports. Boys, for instance, are more often involved in violent activities and therefore, experience more dental trauma than girls (1, 3, 4). Injuries to the teeth occur more often as a result of falls, brawls in the schoolyard and during sport activities such as bicycle riding and contact sports (6). The maxillary

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central incisors are the most commonly affected teeth and the greater is the overjet the higher are the chances of the individual to injure these teeth (7, 8).

In contrast to the aforementioned bulk of reports that refer to healthy individuals, only two studies on the prevalence of dental trauma in children with handicaps were found in a web search (9, 10). In one study (9) dental injuries were detected in 18% of children 5–15 years old. This was higher than the prevalence of dental injury (11%) in a group of healthy children. In the second study (10) 28.8% of the children with handicaps had traumatized their teeth.

Cerebral palsy (CP) is a title for a group of disorders of various causes that are characterized by any non-progressive central motor deficit dating to events in the prenatal or perinatal periods (11). A common feature of the various types of CP is the inability to control involuntary body motions. This limits the mobility of individuals with CP, compels them to be confined to wheelchairs, crutches or walkers and does not allow them to take part in violent sport activities.

The purpose of this study was to assess the characteristic of dental trauma in individuals with CP.

## Material and methods

The study group consisted of a group of children, teenagers and young adults with CP whose mental development is within normal limits and are visiting a day school special for young people with various degrees of CP. The parents were asked to complete a questionnaire regarding their child's age, gender, medical history, ability and equipment needed for mobility and history of dental trauma. All individuals were examined clinically with a dental mirror and an explorer using electric light similar to the light produced by the dental lamp. Four experienced and trained pediatric dentists have performed the oral examinations. The teeth were evaluated for the presence or absence of the following: fractures of the hard coronal tissues; restoration of fractured teeth; missing teeth due to injuries; coronal discoloration (yellow or dark) that has been checked by transillumination; localized hypocalcificied and hypoplastic enamel defects that may result from injuries to the primary incisors and scars on the chin as a possible indicator for trauma to posterior teeth. In addition, overjet was measured with a ruler.

The findings were statistically analyzed using the Student's *t*-test and the chi-square test with level of significance set at P < 0.05.

# Results

The study group consisted of 68 individuals (36 females and 32 males) with an age range of 7–21 years (mean 12.6 and median 12.5). The mean age for males was  $12.0 \pm 3.8$  and for females  $13.4 \pm 4.4$ . Six individuals were able to walk without any aid, three used crutches, nine others needed a walker, 47 required a wheel chair and three had a motorized wheel chair.

Signs of trauma to the permanent teeth were evident in 68 teeth of 39 individuals (57%). Males were slightly less affected than females, 56% (20/36) and 59% (19/32), respectively.

Twenty-nine (43%) had no signs of dental injury. The other thirty-nine individuals had at list one injured tooth. The distribution of individuals by number of injured teeth per child is presented in Table 1. The distribution of types of injury by type of teeth is summarized in Table 2. Sixty-eight teeth were injured with the maxillary central incisors being the most frequently affected teeth with equal distribution between the right and left sides. The most common type of injury was fracture of the enamel and dentin with a rate of 62% (42/68). Eighteen of the teeth with crown fracture (in 12) individuals) were restored with an esthetic composite restoration. Three restorations were lost due to repeated trauma. Only one tooth had evidence of a past luxation injury. Four teeth presented coronal discoloration (three dark and one yellow discoloration) associated with crown fracture or luxation injury.

Scars on the chin were observed in 28% of the individuals with no difference between males and females (10/36 in males and 9/32 in females). Only one 11-year-old child who had injured his chin showed fractures of posterior teeth.

The overjet ranged between -3.0 and +14 mm with a mean of  $5.5 \pm 3.8$  mm. The mean overjet for the injured group was  $5.8 \pm 3.8$  and for the noninjured  $5.1 \pm 3.9$ . Table 3 shows the distributions of individuals with signs of injury to the teeth by degrees of overjet. Differences between injured and non-injured individuals were not statistically significant at any cutting point of the size of the overjet.

Table 1. Distribution of individuals by number of injured teeth per child

Number of injured teeth per child	Number of individuals	Total number of injured teeth	
0	29	0	
1	18	18	
2	15	30	
3	4	12	
4	2	8	
Total	68	68	

#### Table 2. Distribution of types of dental injuries by type of tooth

	Type of tooth					
Type of injury	Right maxillary lateral incisor	Right maxillary central incisor	Right maxillary central incisor	Right maxillary lateral incisor	Primary molar	Total
Enamel cracks	3	9	9	2	0	23
Fracture of enamel and dentin	3	16	17*	5	1	42 <sup>†</sup>
Avulsion	0	1	2 <sup>‡</sup>	0	0	3
Total	6	26	28	7	1	68

\*One tooth had both crown fracture and luxation.

<sup>T</sup>Twelve fractured teeth had esthetic restoration of the fracture. Three of these were lost due to repeated injuries.

<sup>‡</sup>One avulsed tooth has been successfully replanted.

Table 3. Distribution of individuals with signs of dental injuries by degree of overjet

Overjet (mm)	Individuals with dental injury, <i>n</i> (%)	Total number of individuals	
-3.0-0.0	0 (0.0)	4	
0.0-2.5	8 (72.7)	11	
3.0-3.5	4 (66.7)	6	
4.0-4.5	2 (40.0)	5	
5.0-5.5	6 (54.5)	11	
6.0-7.0	10 (66.7)	15	
8.0-11.0	5 (50.0)	10	
12.0–14.0	4 (66.7)	6	
Total	39 (57.4)	68	

P > 0.05 at any cutting point.

Table 4. Prevalence of dental injuries in different age groups

Age groups (years)	Prevalence of	Prevalence of dental injury		
	Males	Females	Total	
7–11	9/20 (45)	3/11 (27)	12/31 (39)	
12–16	6/9 (67)	10/13 (77)	16/22 (73)	
17–21	5/7 (71)	6/8 (75)	11/15 (73)	
Total	20/36 (56)	19/32 (59)	39/68 (57)	

Values are expressed as n (%).

Nine individuals underwent orthodontic treatment five of them with an overjet greater than 7 mm. Of the five individuals who had orthodontic treatment, seven had experienced injuries to the teeth prior to the orthodontic treatment and the other two had no signs of injury to the teeth.

The mean age of individuals with signs of dental injuries was  $13.7 \pm 3.7$  years when compared with  $11.2 \pm 4.4$  of those who did not present signs of dental injuries (Student's *t*-test, P = 0.0152). The prevalence of injuries among the age group of 12-16 years was found to be equal to that of the 17-21 years and 87% higher than that of the 7-11 years group (Table 4). The increase of the prevalence was greater for females than for males (Fig. 1).

Parents of 25 individuals (37%) were able to recall past events in which their children had injured their



Fig. 1. Prevalence of dental injuries in different age groups.

teeth (Table 5). In three cases injuries occurred at a preschool period and therefore no signs of injuries were observed in the teeth. In all cases the teeth were injured as a result of falls at home (in the bathroom, against a table) or at school. Only in one case the parents reported that their child fell in the transportation van that takes the child to and from school. In 17 (25%) clear evidences of dental trauma were evident but parents were not able to recall any event of dental trauma. None of these children had restorations of their fractured teeth. About 55% (10/22) of the individuals whose parents could recall a past injury to the teeth were treated for restoration of the fractured teeth. Parents of most individuals could not recall their child's exact age at time of injury.

Localized enamel defects were detected on the labial surface of 13 teeth in nine individuals. Six teeth presented hypoplastic lesions and the other seven teeth had hypocalcified defects. Seven individuals had both enamel defects and signs of injuries in their permanent incisors.

## Discussion

The prevalence of dental trauma in the group of individuals with CP, as found in the present study,

Table 5. Correlation between parents' recall and clinical evidences of dental injuries

	Recall of dental injuries		
Evidence of dental injuries	Yes	No	Total
Yes	22	17	39
No	3*	26	29
Total	23	43	68

\*Trauma to teeth occurred before eruption of the permanent teeth.

is much higher than that of other studies (2, 3). A higher prevalence of dental injuries was found also by Ohito et al. (9) who evaluated the prevalence of traumatic dental injuries in a normal population and compared to handicapped children aged 5-15 years. However, the prevalence of dental injuries in the present study is still more than three times higher than in the handicapped individuals in Ohito's study. One would claim that the wider age range of the population in the present study (up to 21 years of age) as compared to other reports might provide the explanation for the higher prevalence of trauma. However, Table 4 shows there was no change in the prevalence of dental injuries from the 12–16-year-old group to the 17-21 years old. The CP population differs also in the prevalence of dental injuries by gender. Unlike studies in healthy populations in which males are affected 1.2-2.3 times more than females (1, 3) in the present study females were found to experience slightly more injuries than males do. This can be explained by the difference in activity habits between CP and healthy individuals and the similarity of lifestyle of CP individuals of both genders. Uncontrolled head movements, that are characteristic to individuals with CP, are a common cause for dental injuries as the teeth are bumped against hard objects located in the individual's vicinity. As such movements are equally common in both genders and do not tend to decrease with age the pattern of injuries to the teeth in CP individuals differs from the known pattern in a healthy population.

Several authors claimed that an increased overjet is a predisposing factor for injuries of maxillary incisors (8, 12–14). They found that the greater is overjet the higher are the chances of the individual to injure his/her maxillary teeth. This is in contrast to the finding in the present study that did not detect a higher prevalence of dental injuries in individuals with an increased overjet. This is in accordance with the study by Stokes et al. (15) who compared 36 Singapore schoolchildren, age 7–18 years who had suffered dental trauma, with a control group of 36 children, matched for age, sex, race and sporting activities, but who had not suffered dental trauma. The mean overjet for the trauma group was almost identical with the non-trauma group.

This study was not designed to assess the occurrence of traumatic injuries to the primary dentition. However, based on the presence of localized enamel defects in permanent incisors of nine individuals it can be assumed that the primary incisors had experienced severe luxation injuries at various ages. Seven of these individuals had both localized enamel defects and fractures in same teeth indicating repeated dental injuries. Extraction of all four maxillary incisors was performed in a patient with CP, severe mental retardation, seizure disorder and a 14 mm overjet following numerous injuries to the teeth claiming that the patient has little ability to receive comprehensive orthodontic treatment (16). This treatment option does not seem to fit the population in the present study, as they do not suffer from mental retardation, they react favorably to dental treatment including restoration of fractured teeth and orthodontic treatment. Twelve out of 42 fractured teeth were restored and nine underwent comprehensive orthodontic treatment at the Orthodontic Department of the Hebrew University -Hadassah School of Dental Medicine in Jerusalem Israel.

The significance of chin scars is the sudden and forceful closure of the mandibular teeth with their maxillary opponents that may cause fracture of posterior teeth (17). The prevalence of scars on the chin found in the present study is similar to that found in a healthy population (17) though only one child in the present study had fractured (primary) molars. As the age in which the chin injury occurred was not provided by the parents, it is not impossible that the results of this type of injury was limited to the primary molars that meanwhile exfoliated and were replaced by intact permanent teeth. One of the outcomes of chin injuries are fractures of the mandible and mainly of the subcondyle. The present study was not designed to include radiographs and it was, therefore, not possible to assess the history of fractures of the mandible.

The present study was not designed to assess the number of dental trauma events but the number of individuals with signs of dental trauma. Therefore, repeated injuries to the teeth could only be estimated by signs of enamel defects on the labial surface of the crown of permanent incisors suspecting dental injuries to the primary teeth. In addition, three restorations of fractured permanent teeth were reported to be lost due to repeated injuries to the previously restored teeth. It is reasonable to assume that many of the individuals with CP in this group had experience more than one event of dental injury throughout life. Repeated injuries in individuals with CP, although not recorded in the present study, should not be surprising, as the predisposing factors remain unchanged. In order to assess the incidence of dental injuries in a CP population a longitudinal study should be designed.

As healthy children maintain an unrestricted lifestyle they may injure their teeth during bicycle riding, contact sports and other dynamic activities. Such activities can be ruled out as potential hazards for children and adolescents with CP whose ambulation ability is limited. However, inability of individuals with CP to control abrupt body movements may be a predisposing factor that increases the risk of traumatic injuries to the teeth. In the present study, all injuries except one occurred indoors due to falls and involuntary head movements. Falls were associated with loss of balance while attempting to move from the wheel chair to bed or bathtub or lavatory seat.

The prevalence of dental injuries in a group of individuals with CP was found to be much higher than that of healthy populations despite the fact that CP individuals do not take part in violent sport activities as healthy children do. This should alert caregivers to carry out a profound investigation of the events that result in dental injuries in disabled individuals and seek for preventive measures such as mouthguards, padding hard objects which have the potential of harming the teeth and safe transportation of the children in wheelchairs (18).

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