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Traumatic dental injuries in individuals with cerebral palsy

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Correspondence to: Maria Teresa Botti Rodrigues dos Santos, Rua Constantino de Souza, no. 454, apto 141, 04605-001 São Paulo, Brazil Tel.: +55 11 50930865 Fax: +55 11 3287 5770 e-mail: drsantosmt@yahoo.com.br Accepted 29 September, 2008 Abstract – Background: Cerebral palsy (CP) is one of the most frequent conditions encountered in the daily practice of dentists who treat specialneeds individuals and it seems that traumatic dental injuries are often present in these cases. The aim of this study was to investigate and describe the prevalence related to traumatic dental injury (TDI) in individuals with CP attending rehabilitation treatment at the Lar Escola Sao Francisco Rehabilitation Center in São Paulo, Brazil. Material and Methods: The sample included 100 individuals with a medical diagnosis of CP (SG) aged 1-15 years (mean 7 years 2 months \pm SD 3 years 4 months) and 100 non-disabled individuals (CG), aged 1–15 years (mean 7 years 5 months \pm SD 4 years 0 month), presenting the same socioeconomic level as SG. Data were collected through clinical examinations according to Andreasen criteria and interviews. Results: According to the Gross Motor Function Classification, the SG presented 34.0% of individuals that walked with or without assistive mobility devices and 66.0% required a wheelchair for mobility. The TDI prevalence observed for CG was 32.0% (n = 32), with 20.0% (n = 20) for SG, showing no statistically significant difference (P = 0.053). For both groups, the teeth most affected were the maxillary central incisors. Crown fracture without pulp exposure was the most frequent type of injury (31.2%) in CG and enamel fracture (30.0%), in SG. The groups differed significantly regarding dental treatment received after TDI (P = 0.012), with CG presenting higher percentages of treated individuals. *Conclusions:* The data suggest that the TDI prevalence in individuals presenting CP and attending rehabilitation treatment was similar compared with nondisabled individuals, but they received less treatment.

Traumatic dental injury (TDI) in children and adolescents is a common problem and many authors have reported it in non-disabled individuals (1–5). Studies regarding TDI prevalence have described it as varying from 7.3% to 58.6% (5–12).

Traumatic dental injuries frequently affect both supporting dental structures and hard tissues (13). Besides these local injuries, dental trauma can, directly or indirectly, influence people's lives, affect their appearance, speech, and tooth position, reinforcing that TDI may cause functional, esthetic, psychological (14), and social problems (15).

Cerebral palsy (CP) describes a group of disorders related to movement and posture development, causing activity limitations, which are attributed to non-progressive disturbances that occur in the developing fetal or infant brain. The motor disorders of CP are often accompanied by disturbances of sensation, cognition, communication, perception, behavior and by seizure disorder (16–21). Intellectual impairments occur in about two-thirds of patients presenting CP (22).

Few studies exist describing the TDI prevalence in individuals with special needs. Holan et al. (23) described a prevalence of 57% in CP individuals and Nunn and Murray (24), a prevalence of 28.8% in the handicapped.

Recently in Brazil the government broadened the programs to include dental treatment for disabled individuals without costs for the patient. Despite this, government resources aimed at public health care in Brazil are insufficient in immediately meeting dental care demands of patients. In order to receive treatment, caregivers often incur out of pocket expenses for treatment in private dental clinics.

Therefore, considering the importance of dental trauma in individuals presenting CP, the aim of this study was to investigate and describe the prevalence related to TDI in individuals presenting CP attending rehabilitation treatment at the Lar Escola Sao Francisco Rehabilitation Center, Federal University of São Paulo/School of Medicine (UNIFESP/EPM) in São Paulo, Brazil.

Materials and methods

The Ethics Committee of the Cruzeiro do Sul University (UNICSUL), in São Paulo, Brazil, approved this study and written informed consent for participation and publication was obtained from the adult responsible for each child/individual who participated in the study. This cross-sectional study involved a group of 100 non-institutionalized individuals, 30 females and 70 males, with a medical diagnosis of CP (study group = SG), aged 1–15 years (mean 7 years 2 months \pm SD 3 y 4 months), who were attending rehabilitation treatment at the Lar Escola Sao Francisco Rehabilitation Center, Federal University of São Paulo/School of Medicine (UNIFESP/EPM) in São Paulo, Brazil.

Patient medical records were reviewed for demographic and clinical data, including gender, age, CP severity measured using the Gross Motor Function Classification System levels I–V (25) (level I indicated walking without restrictions with limitations in more advanced gross motor skills; level II indicated walking without assistive devices with limitations walking outdoors and in the community; level III indicated walking with assistive mobility devices with limitations walking outdoors and in the community; level IV indicated selfmobility with limitations, the patient was transported or used a power mobility outdoors and in the community; level V indicated that self-mobility is severely limited even with assistive technology), type of movement disorder (spastic, dystonic, with athetosis), clinical patterns of involvement (quadriplegia, diplegia, hemiplegia), gross household income of the family.

Parents/caregivers were asked to complete a structured questionnaire in the Rehabilitation Center regarding medicines used, presence of convulsions, the dental trauma history, and the cause of the TDI, place of occurrence and subsequent dental treatment received by CP individuals during this initial interview. The interviewer/examiner was one trained and calibrated dental surgeon.

Data related to TDI were collected during the clinical examinations in a dental chair. In some cases one of the parents/caregivers helped holding very young children. As only the anterior maxillary and jaw incisors were examined, and the age ranging for the groups studied varied from 1 to 15 years, TDI was recorded only on teeth present during examination (primary or permanent) Previous TDI in primary teeth were not recorded in the presence of permanent teeth.

Data were recorded on a specific form, according to Andreasen criteria (26). The data included enamel fracture, enamel and dentin fracture without pulp exposure, crown fracture without pulp exposure, crown fracture with pulp exposure, intrusive luxation, extrusive luxation, lateral luxation and avulsion.

A plain mouth mirror and a blunt probe were used to identify the presence and extent of restorations or to remove debris. Prior to examination, the teeth were dried with gauze. The intra-examiner reproducibility was measured by a blind reexamination of 10 random CP individuals participating in the study with a 1-week interval between initial examination and reexamination (kappa 0.96).The treatment received after TDI was given on a case by case basis ranging from no treatment to restoration.

The control group (CG) was composed of 100 nondisabled individuals, 49 males and 51 females, aged 1– 15 years [mean 7 years 5 months \pm SD 4 years 0 month], presenting the same socioeconomic level as the study group, i.e., a gross household income of less than \$7599 determined by the same methodology as the CP group.

Descriptive statistics were used to evaluate the demographic data of each group. To verify the homogeneity of the groups studied in relation to proportions encountered, the chi-squared and Fisher tests were used. The Student's *t*-test was used to verify the null hypothesis (27). The significance level was set at a level of 0.05.

Results

The results concerning demographic characteristics for individuals from the CG and SG are shown in Table 1. The sample was homogenous regarding age (P = 0.503), but not regarding gender (P = 0.002), with the SG presenting a significantly higher percentage of males and use of anticonvulsant drugs (P = 0.001). According to the Gross Motor Function Classification, the SG included 34.0% of individuals that walked, with or without assistive mobility devices, and 66.0% that did not walk, who required a wheelchair for mobility.

The prevalence of TDI in the CG was 32.0% (n = 32) and 20.0% (n = 20) in the SG. Although the CG sustained more TDI, no statistically significant difference (P = 0.053) occurred between the groups. In the CG, boys experienced more injuries than girls, 36.7% (18/49) and 27.5% (14/51), respectively; however, in the SG, the opposite situation was observed, with girls experiencing more injuries than boys, 23.3% (7/30) and 18.6% (13/70), respectively.

A significant association between CP type and TDI presence (P = 0.031) was observed, with diplegia presenting the highest percentage of cases with trauma. A

Table 1. Demographic characteristics of individuals from the control and study groups

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Female 51 (51.0) 30 (30.0) 0.002* ^a Male 49 (49.0) 70 (70.0) 70 Age, mean ± SD 7.5 ± 4.0 7.2 ± 3.4 0.503 ^b Cerebral palsy type - 18 (18.0) 1000000000000000000000000000000000000					
Male 49 (49.0) 70 (70.0) Age, mean ± SD 7.5 ± 4.0 7.2 ± 3.4 0.503 ^b Cerebral palsy type - 18 (18.0) Diplegia - 35 (35.0) Quadriplegia - 39 (39.0) Dystonic with athetosis - 8 (8.0)					
Age, mean ± SD 7.5 ± 4.0 7.2 ± 3.4 0.503 ^b Cerebral palsy type - 18 (18.0) Hemiplegia - 35 (35.0) Quadriplegia - 39 (39.0) Dystonic with athetosis - 8 (8.0)					
Cerebral palsy typeHemiplegia-18 (18.0)Diplegia-35 (35.0)Quadriplegia-39 (39.0)Dystonic with athetosis-8 (8.0)					
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Quadriplegia-39 (39.0)Dystonic with athetosis-8 (8.0)					
Dystonic with athetosis – 8 (8.0)					
Gross Motor Function Classification					
Level I – 12 (12.0)					
Level II - 8 (8.0)					
Level III - 14 (14.0)					
Level IV – 45 (45.0)					
Level V – 21 (21.0)					
Using oral anticonvulsant					
Yes 0 (0.0) 35 (35.0)					
No 100 (100.0) 65 (65.0) 0.001* ^a					
Total 100 (100.0) 100 (100.0)					

Data were compared using: ^achi-squared test, ^bStudent's *t*-test. *P < 0.05.

significant association (P = 0.036) was also observed between anticonvulsant drug use and TDI, indicating that those who did not use this medication presented higher levels of trauma (85%: 17/20).

The teeth most commonly affected were numbers 51 and 61 in the CG (34.4%), and 51 and 61 (20.0%) and 11 (20.0%) in the SG (Table 2).

Table 3 presents the frequency distribution of types of TDI according to group. Crown fracture without pulp exposure was the most frequent type of injury (31.2%), followed by fracture in the enamel/dentin without pulp exposure (21.9%), in the CG and fracture in the enamel (30.0%), followed by fracture in the enamel/dentin without pulp exposure (25.0%), in the SG.

Table 4 presents the distribution of TDI according to cause, place of occurrence, and dental treatment received. For the CG, falls (62.5%) were the most common cause of TDI and for the SG, falls from the individual's wheelchair (45.0%). Home was the most common place of injury occurrence both groups (control: 75.0%; study: 65.0%). The groups differed significantly regarding dental treatment received after injury (P = 0.012), with the CG presenting higher percentages of treated individuals.

In relation to the dentition most affected by TDI, observation revealed that 56.3% and 60.0% occurred in

Table 2. Frequency distribution of traumatic injuries according to affected teeth in control and study groups

Injured teeth	Control group, n (%)	Study group, n (%)	<i>P</i> -value		
11	2 (6.3)	4 (20.0)	0.490		
21	3 (9.4)	3 (15.0)	1.00		
22	1 (3.0)	-	1.00		
11 and 21	2 (6.3)	3 (15.0)	0.660		
51	5 (15.6)	2 (10.0)	0.442		
61	8 (25.0)	4 (20.0)	0.372		
51 and 61	11 (34.4)	4 (20.0)	0.107		
Total	32 (100.0)	20 (100.0)	0.053		
Data were compared using the chi-squared test. $P < 0.05$.					

Table 3. Frequency distribution of types of traumatic dental injuries according to control and study groups

Type of traumatic injury	Control group, n (%)	Study group, n (%)	<i>P</i> -value		
Enamel fracture	4 (12.5)	6 (30.0)	0.746		
Enamel and dentin fracture without pulp exposure	7 (21.9)	5 (25.0)	0.766		
Crown fracture without pulp exposure	10 (31.2)	3 (15.0)	0.085		
Crown fracture with pulp exposure	2 (6.2)	-	0.478		
Intrusive luxation	5 (15.8)	2 (10.0)	0.442		
Extrusive luxation	2 (6.2)	2 (10.0)	1.0		
Lateral luxation	2 (6.2)	1 (5.0)	1.0		
Avulsion	_ ` `	1 (5.0)	1.0		
Total	32 (100.0)	20 (100.0)	0.053		
Data were compared using the chi-squared test. $P < 0.05$.					

Table 4. Distribution of traumatic dental injuries according to cause, place of occurrence, and dental treatment received

	Control group, n (%)	Study group, n (%)	<i>P</i> -value	
Cause of traumatic dental injuries				
Falls	20 (62.5)	8 (40.0)	<0.001	
Falls from the wheelchair		9 (45.0)		
Collisions	2 (6.3)	-		
Sports	1 (3.1)	-		
Bad use of teeth	-	1 (5.0)		
Fun and leisure activities	9 (28.1)	2 (10.0)		
Total	32 (100.0)	20 (100.0)	0.053	
Place of occurrence				
At home	24 (75.0)	13 (65.0)	0.404	
At school	1 (3.2)	3 (15.0)		
On street	7 (21.8)	4 (20.0)		
Total	32 (100.0)	20 (100.0)	0.053	
Dental treatment received				
Yes	27 (84.3)	10 (50.0)	0.012*	
No	5 (15.7)	10 (50.0)		
Total	32 (100.0)	20 (100.0)		

Data were compared using the chi-squared test.

**P* < 0.05.

mixed dentition for the control and study groups, respectively.

Discussion

The present study identified a prevalence of 20% for TDI in individuals presenting with CP, who attended rehabilitation treatment in a rehabilitation center, similar to that reported by Nunn and Murray (24) (28.8%) and lower than that found by Holan et al. (23) (57.0%). Comparisons between studies should be interpreted with caution due to the lack of uniformity in sample selection, examination procedures, diagnostic criteria, and age groups.

In this study, 70% of the individuals in the SG were male, in agreement with Murphy et al. (16), who found a higher prevalence of CP in males (odds ratio = 1.5; 95%) CI = 1.1-2.0) and Bax et al. (21), who found 61.9%prevalence. CP individuals differ in their TDI prevalence according to gender. Unlike studies in healthy populations and in the non-disabled CG of this study, in which boys are more often affected than girls (2-4, 6-12, 28), girls presenting CP experienced slightly more trauma than boys. Holan et al. (23) found the same experience in girls presenting CP. This can be explained by the differences in habitual activity between CP and healthy individuals and the similarities in lifestyle between CP individuals of both genders. Dental trauma in CP individuals can result from mental retardation, poor and/or uncontrolled motor coordination, the presence of unwanted and/or involuntary physical movements, oral pathological reflexes, such as the biting reflex during feeding, spasticity in masticatory muscles, or a slower response to surrounding obstacles. As such conditions are similarly common in both genders, the patterns of TDI in CP individuals clearly differ from that in nondisabled individuals.

Clinically, 18.0% of individuals from the SG presented hemiplegia and 35.0% diplegia, results similar to those found by Bax et al. (21). Regarding the use of anticonvulsant drugs, observation showed a lower percentage of CP individuals with TDI who were anticonvulsant drug users. This indicates that the drug combinations used were effective in controlling the frequency of seizure attacks.

Primary and permanent upper central incisors were the teeth most involved in dental trauma in both groups, as described in previous studies (1, 4, 5, 23, 28). The importance of this finding lies in the fact that trauma to primary incisors can develop into pulpal, periodontal complications, and/or developmental disturbances of permanent successors, and that trauma involving permanent incisors could impair esthetic, phonetic, and functional activities (14, 15). Fractures involving only the enamel and the enamel and dentine without pulp exposure were the most frequent types of TDI observed in the SG, corroborating the findings of previous studies (1, 2, 6, 8, 9, 23, 29).

Certain activities could be indicated as potential hazards during daily routine, fun, leisure, or even during rehabilitation treatment for individuals presenting CP, whose ambulatory ability is limited. The inability of this group to control their movements may be a predisposing factor to the increased risk of TDI. In the present study, almost half (45.0%) of the CP group fell at home from their wheelchair, as observed by Malikaew et al. (3) and Rajab (14). According to the literature (3, 6, 8, 10), falls and collisions are the main causes of dental trauma, as confirmed in this study.

Falls were associated with loss of stability, while attempting to move from the wheelchair to the bed, bathtub, and lavatory seat. Mouthguard appliances with uses ranging from protective to therapeutic could be indicated to prevent oral trauma in CP individuals, taking into account patients' understanding, age, feeding ability, spasticity, degrees of masticatory muscles, and caregivers' training (30).

Among those children who had experienced TDI to the teeth, 50% of CP individuals presented were untreated damage. Marcenes et al. (5) found 93.1% also were untreated among 9- to 12-year-old schoolchildren in Damascus, Syria, and Marcenes et al. (12) 97.3% need treatment in schoolchildren aged 12 years in Blumenau, Brazil. Regarding dental treatment after TDI for individuals presenting CP, some points should be raised regarding the possible causes for receiving less treatment. Multiple and complex rehabilitation treatment needs, the level of dependence on caregivers, the need to be accompanied, problems with transportation, building access (entry and exit), negative attitudes of the general public, the cost of dental care, the presence of comorbidities and negative attitudes to dental care, including fear and resistance from early painful prior experiences, or simply the fact that these individuals did not seek treatment. Requesting help and advice is of great importance in preventing, or at least minimizing, the effects of dental trauma (2).

Treating CP patients at outpatient clinic level is always challenging. These individuals require a type of

approach and positioning that permits the delivery of dental treatment in the safest and most efficient manner possible. Both assistive stabilization and postural maintenance forms of positioning CP individuals on the dental chair according to the neurodevelopmental treatment approach are not commonly used by dental practitioners who lack experience in a rehabilitation context, and sometimes they may feel insecure when delivering dental care to severely impaired individuals at an outpatient clinic level (31). Thus, a large number of CP individuals remain without dental assistance and this is proof of the necessity for further education of our dental practitioners in this specialization.

This cross-sectional study is the baseline for a future longitudinal study of the CP group. The recalls for examination will be scheduled every 6 months, for the next 3 years. The self report by caregivers in finding treatment, types of treatment received, and new TDI are instrumental to continued care regimens.

Conclusion

Present data suggest that the prevalence of TDI in individuals presenting with CP and attending a rehabilitation treatment was similar to that of non-disabled individuals, but the individuals presenting with CP received less treatment.

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