S. Bagattoni, A. Sadotti, G. D'Alessandro, G. Piana

Department of Biomedical and NeuroMotor Sciences (DiBiNeM), Unit of Dental Care for Special Needs Patients and Paediatric Dentistry, University of Bologna, Bologna, Italy

email: simone.bagattoni2@unibo.it

Dental trauma in Italian children and adolescents with special health care needs. A cross-sectional retrospective study

ABSTRACT

Aim *Dental trauma is a frequent finding in people with special health care needs. The aim of this study was to determine the prevalence of dental trauma in a sample of Italian children and adolescents with special health care needs.*

Materials and methods *556 medical and dental records of children and adolescents visited from January 2010 to March 2015 were examined. Information about medical diagnosis, gender, site and type of dental trauma (DT) were collected. According to age and reflecting the dentition stage, the sample was divided into 3 groups: subjects aged 0–5 years (group A, primary dentition), 6–11 years (group B, mixed dentition), 12–18 years (group C, permanent dentition).*

Results *113 individuals experienced a DT (prevalence 20.3%), with no difference in relation to gender. Individuals with cerebral palsy and autism showed the highest frequency of DT: 39.6% and 30.4%, respectively. The highest frequency of DT occurred both in group A (21.8%) and B (21.5%), which differed significantly from group C (9%). Avulsion was the most frequent type of DT in the primary dentition (24%) and enamel-dentin fracture without pulp exposure in the permanent dentition (60%). Upper central incisors were the most affected teeth.*

Conclusion *The prevalence of DT in a sample of Italian children and adolescents with special health care needs is high, especially in young individuals with cerebral palsy and autism. Preventive strategies for those patients should be developed in order to reduce the risk of DT.*

Keywords *Disabled children; Traumatology; Tooth; Prevalence.*

Introduction

Subjects with special health care needs (SHCN) have an increased risk for oral diseases throughout their life [Anders and Davis, 2010]. Compared to the healthy population, people with SHCN have a higher risk of caries and periodontal diseases [Lewis, 2009]. This data could be related to congenital or developmental teeth anomalies, poor oral hygiene, and/or to the difficult access to medical facilities specialised in treating SHCN people. Multiple studies examined the oral health status of SHCN children [Shapira et al., 1989; De Jongh et al., 2008; D'Alessandro et al., 2014], but only few described the prevalence of dental trauma (DT). In subjects with SHCN, as well as in the healthy population, the management of DT often involves a multidisciplinary approach [Andreasen et al., 2007]. In addition, recent studies showed that DT experience had a negative impact on children's and parents' quality of life [Berger et al., 2009; Porritt et al., 2011]. Dental trauma in SHCN people occurs both at a young age, during which growth and development take place, and in adulthood [Andreasen et al., 2007]. Many authors described the DT prevalence in healthy children and adolescents, ranging from 7.3% [Zerman and Cavalleri, 1993] to 58.6% [Marcenes et al., 2010]. Only a few described the DT prevalence in children and adolescents with SHCN, ranging from 9.2% [Ferreira et al., 2011] to 28.8% [Nunn and Murray, 1987].

Given the lack of data in Italy, the aim of this study was to investigate the DT prevalence in a sample of Italian children and adolescents with SHCN.

Materials and methods

The local Ethics Committee of the Bologna University Hospital Authority St. Orsola-Malpighi Polyclinic (Bologna, Italy) approved this study (PG. N 0019293 20/06/2014).

Two authors, with a qualified training in special need dentistry, screened the medical and dental records of all the subjects with SHCN (N= 1,498) attending the Unit of Dental Care for Special Needs Patients (Department of Biomedical and Neuromotor Sciences, Bologna University, Italy) from January 2010 to March 2015. The selection of the study sample was performed following strict inclusion criteria: age at the last dental visit <18 years; documented medical diagnosis of cerebral palsy (CP), autism, epilepsy without intellectual disability, psychiatric impairment, visual and/or hearing deficiency, Down syndrome (DS), other syndromes/medical conditions associated with intellectual disability or with ambulation disorders. All the medical and dental records that did not meet those inclusion criteria or

Medical diagnosis	DT	
	presence n (%)	absence n (%)
Cerebral palsy	21 (39.6)*	32 (60.4)
Autism	14 (30.4)*	32 (69.6)
Epilepsy	6 (18.8)	26 (81.2)
Psychiatric impairment	3 (17.6)	14 (82.4)
Visual and/or hearing deficiency	1 (12.5)	7 (87.5)
Down syndrome	15 (8.5)	162 (91.5)
Intellectual disability	34 (20.0)	131 (80.0)
Ambulation disorders	9 (15.5)	156 (84.5)
n = sample. Chi-squared test, * means significant difference (p < 0.05)		

TABLE 1 DT prevalence, according to medical diagnosis.

Primary teeth	n (%)
51	37 (42.5)
52	5 (5.7)
61	35 (40.2)
62	6 (6.9)
63	1 (1.1)
71	1 (1.1)
81	1 (1.1)
82	1 (1.1)
Total (n)	87

TABLE 2 Frequency distribution of DT according to affected teeth in primary dentition.

Permanent teeth	n (%)
11	40 (47.6)
12	4 (4.8)
21	37 (44.0)
22	3 (3.6)
Total (n)	84

TABLE 3 Frequency distribution of DT according to affected teeth in permanent dentition.

with an incomplete documentation were excluded from the study. Following the screening, 556 records matched the inclusion criteria: 311 male (55%), 245 female (44.1%), mean age 9.2 years. Based on age and reflecting the dentition stage, the sample was divided into 3 groups: group A, 0–5 years, primary dentition (n=238); group B, 6–11 years, mixed dentition (n=172); group C, 12–18 years, permanent dentition (n=146). According to the medical diagnosis, the sample was divided into 8 groups: DS (n=177), syndromes or other medical conditions associated with intellectual disability (n=165), syndromes or other conditions associated with ambulation disorders (n=58); CP (n=53), autism (n=46), epilepsy without intellectual disability (n=32), psychiatric impairment (n=17), visual and/or hearing deficiency (n=8). The selected records were examined for history of DT, age at DT and type of DT. Dental trauma was classified according to the system adopted by the World Health Organization, proposed by Andreasen et al. [2007]: infraction, enamel fracture, enamel-dentin-pulp fracture without pulp exposure, enamel-dentin-pulp fracture, uncomplicated crown-root fracture, complicated crown-root fracture, root fracture, alveolar fracture, concussion, subluxation, lateral luxation, intrusive luxation, extrusive luxation, and avulsion. Records with an incomplete documentation were excluded from the study. If more than one type of injury occurred in the same tooth, the trauma was classified according to the most serious damage.

Statistical analyses

The number of subjects, gender and mean age were analysed by descriptive statistics. Chi-square test was used to verify the presence/absence of statistically significant differences for gender, age, type of DT, and medical diagnosis. The level of significance was set at $p < 0.05$. SPSS for Windows (18.0, SPSS Inc, Chicago, IL, USA) was used.

Results

One hundred-thirteen subjects experienced some type of DT, with a prevalence rate of 20.3%. Ten dental records did not clearly identify the type of DT and were excluded from further analyses. The final sample included 103 subjects (55.3% male, 44.7% female). Chi-squared test showed no statistically significant difference between genders ($p > 0.05$). Ninety-one children (88.3%) had only one DT, 12 (11.7%) had more than one DT experience. According to age, the highest frequency of DT occurred in group A (52/238, 21.8%) and B (37/172, 21.5 %), which differed significantly from group C (14/146, 9.6%) (Chi-square test; $p < 0.05$).

Table 1 shows the DT frequency according to the medical diagnosis. Subjects with CP and autism showed the highest frequency: 39.6% and 30.4% respectively. Comparing DT frequency in subjects with CP and autism with the rest of the sample, a statistically significant difference was found (Chi-square test; $p < 0.05$). No statistically significant difference between CP and autism was found (Chi-square test; $p > 0.05$).

Dental trauma was seen in 87 primary teeth and 84 permanent teeth. In both dentitions, the most affected teeth were the upper central incisors (Table 2, 3). Table 4 shows the frequency distribution of the different types of DT in primary and permanent teeth. In primary teeth, avulsion was the most common finding (24%) followed by subluxation (20%); in permanent teeth enamel-dentin fracture without pulp exposure (60%) followed by enamel fracture (13%). Comparing the primary and the permanent dentition, the chi-squared test showed a significant difference ($p < 0.05$) for subluxation (more common in primary teeth) and enamel-dentin fracture without pulp exposure (more common in permanent teeth).

Discussion

The present study shows the first data on DT prevalence in children and adolescents with SHCN in Italy. Many epidemiological studies investigated the prevalence of DT in the healthy population. A review of the medical literature published 12 years ago reported that 1/3 of all preschool

Type of trauma	primary teeth n (%)	permanent teeth n (%)	p-value
Enamel fracture	7 (8)	11 (13)	0.409
Enamel-dentin-pulp fracture without pulp exposure	18 (21)	50 (60)	0.000*
Enamel-dentin-pulp fracture	3 (3)	3 (3)	0.710
Root fracture	2 (2)	0	0.492
Aalveolar fracture	2 (2)	0	0.492
Concussion	2 (2)	2 (2)	0.638
Subluxation	17 (20)	1 (1)	0.000*
Lateral luxation	5 (6)	0	0.076
Intrusive luxation	6 (7)	1 (1)	0.013
Estrusive luxation	4 (5)	6(7)	0.702
Avulsion	21 (24)	10 (12)	0.060
Total (n)	87	84	
n = sample. Chi-squared test , * means significant difference			

TABLE 4 type of DT in primary and permanent dentition.

children suffered a DT involving the primary dentition, 1/4 of all schoolchildren and almost 1/3 of adults suffered a trauma to the permanent dentition [Glendor et al., 2007]. Data regarding DT in SHCN children and adolescents are lacking and the different methodologies used in previous studies make it difficult to make comparisons. In the present study, the prevalence of DT in children and adolescents with SHCN in Italy was 20.3%, which is similar to that reported in Kenya and Kuwait [Ohito et al., 1992; Shyama et al., 2001]. Brazilian SHCN children showed lower prevalence [Ferreira et al., 2011]. It should be taken into consideration that an underestimation of DT prevalence may be present across all studies due to the under diagnosis of DT episodes, such as cases of minor DT overlooked by parents and not referred to the specialist for a dental visit.

Our data showed that children under the age of 12 have a significantly higher percentage of DT than older adolescents. A similar finding was reported by Costa et al. [2008] in subjects with CP. During childhood, children are often hyperactive, they learn to walk and interact with other children at school and accidental falls caused by loss of balance are common [Andreasen et al., 2007]. In children with SHCN the beginning of these activities is delayed compared to the healthy population [Costa et al., 2008], and this could lead to a higher risk of DT to the permanent dentition due to accidental falls at an older age. During adolescence, the reduced physical activity of subjects with SHCN may lower the risk of DT and explain the lower prevalence in this age group.

Males and females with SHCN showed similar DT prevalence, in line with previous studies [Ferreira et al., 2011; Costa et al., 2008; Holan et al., 2005; Petti et al., 1996; dos Santos and Souza 2009]. The risk factors for DT in children and adolescents with SHCN are related to poor coordination, intellectual disability and/or muscular hypotonia that predispose equally both males and females to accidental falls [Ferreira et al., 2011]. Compared to the past 10 years, it is interesting to note that even in the healthy population the difference regarding DT prevalence between genders is decreasing [Zerman and Cavalleri, 1993; Joseffon and Karlander, 1994; Glendor et al., 2007]. In the modern society girls, compared to boys, are equally exposed to the same DT risk factors probably due to their involvement in similar physical activities such as sports (cycling, skateboarding, basketball, volleyball, football) [Traebert et al., 2006].

In the present study, the DT frequency in subjects with CP was the highest (39.6%) among the various groups of diseases. It was similar to that reported by Cardoso et al. [2015] (36.3%), higher than that reported by Ferreira et al. [2011] (12.5%), Costa et al. [2008] (10.6%), dos Santos and Souza [2009] (20%) and Miamoto et al. [2011] (18%), and lower than that reported by Holan et al. [2005] (57%). Subjects with CP suffer from uncontrolled and involuntary head movements, alterations of the muscle tone, slower defense mechanisms, and spasticity [Cardoso et al., 2015]. In addition, intellectual disability and epilepsy are common findings. All these factors reduce the coordination and safety of the movements and increase the risk of accidental falls during the daily activities. The poor muscle tone is associated to lip incompetence and increased overjet which is an important risk factor for DT.

Our study showed a high frequency (30.4%) of DT in children and adolescents with autism, with a significant difference between autism and the remaining groups of diseases. Children with autism were often described as hyperactive. This could be related to the associated comorbidity of Attention-Deficit/Hyperactivity Disorder. Self-injuries are also common findings: these include movements such as head banging. More than 75% of these injuries involves the head and neck region [Gandhi and Klein, 2014]. A poor muscle tone, poor motor planning, toe walking and deficits in motor coordination are also common findings in people with autism increasing the risk of DT [Altun et al., 2010]. Only few studies in the literature investigated the DT frequency in children with autism. Fournier et al. [2010] reported a DT frequency of 23% in 93 children and young adults, with no statistically significant difference with the healthy controls; Ferreira et al. [2011] a DT frequency of 27.3% in 11 children. Recently, Du et al. [2015] found a similar DT frequency in children with and without autism.

A low frequency of DT was found in subjects with DS. Down syndrome is not always associated with severe intellectual disability or serious ambulation disorders and the protuberant large tongue associated with the syndrome may play a protective role during accidental falls. However, further studies are necessary to clarify the correlation between DT and DS.

Regarding DT in children and adolescents with epilepsy,

psychiatric impairments, visual and/or hearing deficiency, intellectual disability and ambulation disorders it is hard to make comparisons with other studies because of the lack of data in the medical literature.

The highest frequency of DT occurred in children younger than 12 years. Accidental falls (e.g. from baby carriages, down the stairs, or against hard objects) are the predominant cause of DT in both healthy and SHCN young children [Andreasen et al., 2007; dos Santos and Souza, 2009]. The frequency of luxation injuries (concussion, subluxation, lateral luxation, intrusive luxation, extrusive luxation, and avulsion) in the primary dentition is shown in Table 4. In young children, the resilience of the alveolar bone, which is less dense and less mineralised with large bone marrow spaces, makes luxation injuries more common than crown fractures [Andreasen et al., 2007]. In older children, the probability of a root or crown fracture is higher because of the increased mineralisation and rigidity of the alveolar bone [Crespi, 1992]. Our results showed that enamel-dentin fracture without pulp exposure (60%) is the most common type of DT in the permanent dentition. Dental avulsion was also a common finding (12%) (Table 2).

As shown in Tables 2 and 3, the upper central incisors were the most affected teeth both in primary and permanent dentitions. A traumatic injury to a primary incisor can directly or indirectly damage the development of the permanent successors, and a DT to a permanent incisor – such as avulsion - may irremediably compromise the smile aesthetic; in particular, restorative and endodontic treatments can be very difficult in SHCN children and adolescents because of poor cooperation [Ferreira et al., 2011].

Conclusion

This first Italian study suggests that, in a sample of subjects with SHCN, children and adolescents with CP and autism exhibit the highest DT frequency. Given the high risk of DT in children and adolescents with SHCN, the impact on the quality of life, the multiple and complex rehabilitation treatment needs, the difficult access to specialised medical facilities and the cost of dental care, developing preventive programs for health professionals and caregivers (e.g. paediatricians, nurses, teachers, trainers) is necessary to minimise the effects of DT. Paediatric dentists should be prepared to manage DT, to provide the correct information to the parents and to reduce dental risk factors for DT, as increased overjet.

Acknowledgment

We would like to thank "Fondazione del Monte" (Bologna, Italy) for the support.

References

› Altun C, Guven G, Yorbik O, Acikel C. Dental injuries in autistic patients. Pediatr Dent 2010 Jul-Aug;32(4):343-6.
› Anders PL, Davis EL. Oral health of patients with intellectual disabilities: a systematic review. Spec Care Dentist 2010 May-Jun;30(3):110-7.
› Andreasen JO, Andreasen FM, Andersson L. Textbook and color atlas of traumatic injuries to the teeth, 4th edn. Oxford: Blackwell Munksgaard; 2007.
› Berger TD, Kenny DJ, Casas MJ, Barrett EJ, Lawrence HP. Effects of severe dentoalveolar trauma on the quality-of-life of children and parents. Dent Traumatol. 2009 Oct;25(5):462-9.
› Cardoso AM, Silva CR, Gomes LN, Gomes MD, Padilha WW, Cavalcanti AL. Dental trauma in Brazilian children and adolescents with cerebral palsy. Dent Traumatol 2015 Dec;31(6):471-6.
› Costa MM, Afonso RL, Ruviere DB, Aguiar SM. Prevalence of dental trauma in patients with cerebral palsy. Spec Care Dentist 2008;28:61–4.
› Crespi PV. Intrusive injuries to the dentition. N Y State Dent J 1992 Feb;58(2):35-8.
› D'Alessandro G, Cremonesi I, Alkhamis, Piana G. Correlation between oral health in disabled children and depressive symptoms in their mothers. Eur J Paediatr Dent 2014 Sep;15(3):303-8.
› De Jongh A, Van Houtem C, Van Der Schoof M, Resida G, Broers D. Oral health status, treatment needs, and obstacles to dental care among noninstitutionalized children with severe mental disabilities in The Netherlands. Spec Care Dentist 2008;28:111–15.
› dos Santos MT, Souza CB. Traumatic dental injuries in subjects with cerebral palsy. Dent Traumatol 2009 Jun;25(3):290-4.
› Du RY, Yiu CK, King NM, Wong VC, McGrath CP. Oral health among preschool children with autism spectrum disorders: A case-control study. Autism 2015 Aug;19(6):746-51.
› Ferreira MC, Guare RO, Prokopowitsch I, Santos MT. Prevalence of dental trauma in subjects with special needs. Dent Traumatol 2011 Apr;27(2):113-6.
› Fournier KA, Hass CJ, Naik SK, Lodha N, Cauraugh JH. Motor coordination in autism spectrum disorders: a synthesis and meta-analysis. J Autism Dev Disord 2010 Oct;40(10):1227-40.
› Gandhi RP, Klein U. Autism spectrum disorders: an update on oral health management. J Evid Based Dent Pract 2014 Jun;14 Suppl:115-26.
› Glendor U, Andersson L, Andreasen JO. Economic aspects of traumatic dental injuries. In: Andreasen JO, Andreasen FM, Andersson L editors. Textbook and color atlas of traumatic injuries to the teeth. 4th edn. Oxford: Blackwell Munksgaard; 2007. p. 861–8.
› Holan G, Peretz B, Efrat J, Shapira Y. Traumatic injuries to the teeth in young subjects with cerebral palsy. Dent Traumatol 2005;21:65–9
› Holan G, Peretz B, Efrat J, Shapira Y. Traumatic injuries to the teeth in young subjects with cerebral palsy. Dent Traumatol 2005; 21:65–9.
› Lewis CW. Dental care and children with special health care needs: a population-based perspective. Acad Pediatr. 2009;9(6):420–6
› Joseffson E, Karlander EL. Traumatic injuries to permanent teeth among Swedish school children living in a rural area. Swed Dent J 1994;18:87-94.
› Marcenes W, Zabot NE, Traebert J. Socio-economic correlates of traumatic injuries to the permanent incisors in schoolchildren aged 12 years in Blumenau, Brazil. Dent Traumatol 2001 Oct;17(5):222-6.
› Miamoto CB, Ramos-Jorge ML, Ferreira MC, Oliveira Md, Vieira-Andrade RG, Marques LS. Dental trauma in subjects with severe cerebral palsy: prevalence and associated factors. Braz Oral Res 2011 Jul-Aug;25(4):319-23.
› Nunn JH, Murray JJ. The dental health of handicapped children in newcastle and northumberland. Br Dent J 1987;162:9–14.
› Ohito FA, Opinya GN, Wang'ombe J. Traumatic dental injuries in normal and handicapped children in Nairobi, Kenya. East Afr Med J 1992; 69:680–2.
› Petti S, Tarsitani G, Arcadi P, Tomassini E, Romagnoli L. The prevalence of anterior tooth trauma in children 6 to 11 years old. Minerva Stomatol 1996 May;45(5):213-8.
› Porritt JM, Rodd HD, Ruth Baker S. Quality of life impacts following childhood dento-alveolar trauma. Dent Traumatol 2011 Feb;27(1):2-9.
› Shapira J, Mann J, Tamari I et al. Oral health status and dental needs of an autistic population of children and young adults. Spec Care Dentist 1989;9:38–41.
› Shyama M, al-Mutawa SA, Honkala S. Malocclusions and traumatic injuries in disabled schoolchildren and adolescents in Kuwait. Spec Care Dentist 2001 May-Jun;21(3):104-8.
› Traebert J, Bittencourt DD, Peres KG, Peres MA, De Lacerda JT, Marcenes W. Aetiology and rates of treatment of traumatic dental injuries among 12-year-old school children in a town in southern Brazil. Dent Traumatol 2006;22:173–8.
› Zerman N, Cavalleri G. traumatic injuries to permanent incisors. Endod Dent Traumatol 1993;9:61-4.