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Prevalence and factors associated to dental trauma in infants 1–3 years of age

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Correspondence to: Patrícia Maria Pereira de Araújo Zarzar, Rua Henrique Cabral, 342/104 São Luiz, Cep 31, Minas Gerais, Brazil Tel.: +55 31 3234 6968 Fax: +55 31 3409 2470 e-mail: patyzarzar@hotmail.com Accepted 22 August, 2008 Abstract – The aims of this study were to assess the epidemiology of traumatic dental injuries (TDI) to primary teeth in infants and toddlers between 1 and 3 years of age and investigate whether TDI was related to biological and social factors. A representative sample of infants and toddlers in the city of Belo Horizonte, Minas Gerais, Brazil (n = 519) was examined during a vaccination campaign. The evaluation of clinical signs of previous dental trauma was performed by nine previously calibrated examiners (intra-examiner Kappa = 0.95%; inter-examiner Kappa = 0.88\%). Data were analysed through descriptive analysis, the chi-squared test (P < 0.050) and logistic regression. The prevalence of dental trauma was 41.6%. Among the 519 children examined, 193 (37.2%) had enamel fractures, 30 (5.7%) had enamel-dentin fractures and only three (0.6%) had enamel-dentin fractures involving the pulp. Dental care had been performed within the first 24 h in 4.1% of the sample and after 36 h in 0.8% of the sample. There was no statistically significant difference between genders. The most reported aetiologies were falls (28.8%) and collisions (6.8%). There were no statistically significant associations between the prevalence of dental trauma and non-nutritive sucking habits, dental caries or lip incompetence (P > 0.050). Children of mothers with low levels of schooling (0–6 years of study) had a greater prevalence of TDI (P = 0.001). The results of the logistic regression also demonstrated a significant association between dental injury and the Social Vulnerability Index (P = 0.045). Children from families with high social vulnerability (worse living conditions) had a 1.51 (95% confidence interval 1.0-2.2) greater chance of exhibiting TDI. These results can help guide the implementation of health promotion policies.

Dental trauma is a serious dental public health problem among children (1, 2). Trauma in primary teeth can result in pain and affect the development of the permanent dentition (1, 3). The most common effects on the permanent successors are defects in mineralization or tooth morphology (4, 5), changes in colouration and enamel defects (6). In Brazil, the reported prevalence of trauma to the primary teeth ranges from 9.4 to 35.5%(2, 3, 7, 8). This variation may be because of differences in data collection, sample selection or locations in which the studies were conducted (3).

Lip incompetence (9), dental caries (10) and overjet (9, 11) constitute predisposing factors to dental trauma. How and where dental trauma occurs, the types of trauma and aetiological factors are sources of important information to dentists, with which they can inform parents on how best to prevent dental injuries. A few reports on dental injuries have included socioeconomic indicators, but the results have been inconsistent and conflicting (2, 12–14). Therefore, such associations require clarification (2).

The aims of this study were to assess the epidemiology of dental trauma to primary teeth in children between 1 and 3 years of age; determine aetiological and predisposing factors; and investigate whether dental trauma is related to socioeconomic factors.

Material and Methods

Subjects

A cross-sectional study was carried out on girls and boys aged 1–3 years attending public health services in the city of Belo Horizonte in August 2006. Participants were selected from all children attending a National Children's Vaccination Day. The vaccination program in Belo Horizonte had consistent uptake rates of over 78%.

Belo Horizonte is the state capital of Minas Gerais, Brazil. It is an industrialized city with considerable economic, social and cultural disparities. It has approximately 2.4 million inhabitants and is geographically divided into nine administrative districts. To ensure representation and randomization, each administrative district was used for sampling of participants. Each region had a public health centre responsible for the vaccination of children living in the area.

The children participated in the study during the National Children's Vaccination Day in order of arrival. A term of informed consent was signed by the parents. Nine dentists carried out interviews with the children's parents/guardians and filled out the forms for the examination, adapted from Cardoso & Rocha (15). The forms included questions regarding the mother's

level of schooling, history of dental injuries, sucking habits, dental care following the trauma and an examination of hard and soft tissues.

The sample size was calculated to give a standard error of 4.0% or less. A 95% confidence interval (CI) level and 30.2% prevalence – Bijella et al. (7) – of primary tooth injuries were used. Minimum sample size for satisfying the requirements was estimated to 506 children. To compensate for possible losses during the survey of data, the sample size was increased by 10%. Thus, a total of 557 children were selected. After losses, 519 children were examined.

Examination methods

The dental examinations were carried out by nine dentists – one for each public health district. The dental injuries were classified according to Andreasen (16). Tooth discolouration was also included among the criteria. The examiners received illustrations of the classifications and examples of how to correctly complete the forms.

The nine dentists participated in a training and calibration exercise. The training was performed with colour slides of each type of injury to the primary dentition; two pictures of each injury were included. The results of the examinations were compared with the judgement of an experienced dentist in traumatology. Intra-examiner and inter-examiner agreement was acceptable (Kappa = 0.95 and 0.88). A pilot study involving 10 children and their parents was carried out at a day care centre in Belo Horizonte and no changes were made to the proposed methodology.

The dental examinations were carried out in a kneeto-knee position and a Petzl zoom headlamp provided a standardized light. Pacifier and finger sucking habits were recorded. Caries was diagnosed according to the World Health Organization criteria. Socioeconomic factors were classified according to the Social Vulnerability Index (SVI) (17). This index includes 20 variables for quantifying access to housing, schooling, income, jobs, legal assistance, health and nutrition. Thus, the SVI measures social access and determines to what extent the population of each region of the city is vulnerable to social exclusion.

Statistical methods

Descriptive statistics was used to describe the frequency distributions. Statistical significance for the association between the occurrence of traumatic dental injuries (TDI) and gender, lip coverage, dental caries, mother's schooling and the SVI was determined using the chisquared test as well as simple and multiple logistic regression analyses. Spearman's correlation was used to associate age and the number of teeth with dental trauma. The level of significance was set to 5%. The Statistical Package for the Social Sciences (spss, SPSS Inc., Chicago, IL, USA) software, version 12.0 was used.

The Ethics Committee for Research on Human Subjects at the Federal University of Minas Gerais approved the present research project. Children with any type of dental injury were directed to the dental trauma clinic at the Federal University of Minas Gerais.

Results

Signs of traumatic injuries were found in 216 (41.6%) of the 519 examined children, affecting 355 teeth. Age was significantly correlated to the number of teeth affected (P = 0.001), revealing a larger number of injured teeth with an increase in age. There was no significant difference in the prevalence of TDI between boys and girls. Among the 519 children, 193 (37.2%) had enamel fractures, 30 (5.7%) had enamel-dentin fractures and three (0.6%) had enamel-dentin fractures involving the pulp (some children had more than one dental injury). Soft tissue injuries were observed in 12 children (2.3%) and crown discolouration was detected in eight children (1.5%).

A 24% of the children had experienced trauma to a single tooth, whereas 11.8% had two teeth affected and 4.6% had 3-6 teeth affected. The maxillary central incisors were the most frequently traumatized teeth. Among the 216 children with TDI, only 26 (5.0%) with the affected teeth were treated. A total of 14 (4.1%)children had received dental care within the first 24 h following the incident, while four (0.8%) received dental care after 36 h. Falls (29.8%) were the greatest cause of trauma, followed by collisions (6.8%) (Table 1). Most incidents of TDI (32%) occurred at home, on the street (1.7%) and at day care centres (0.8%). Neither the presence of dental caries (P = 0.078), non-nutritive sucking habits (P = 0.559) nor incompetent lip (P = 0.067) was nominally statistically significant in relation to the prevalence of TDI (Table 2).

The prevalence of dental trauma was related to socioeconomic indicators. There were positive significant associations between dental trauma and the SVI (P = 0.045) as well as mother's schooling (P = 0.001) (Table 2). Children with mothers having low levels of schooling (0–6 years of study) had a greater prevalence of trauma (P = 0.001). The logistic regression analysis confirmed that gender was not significantly associated with the occurrence of trauma. A statistically significant association between the SVI and the incidence of trauma was found (P = 0.045). Children from families with high social vulnerability had a 1.51 (95% CI 1.0–2.2) greater chance of exhibiting trauma than other children (Table 3).

Table 1. Frequency distribution of injuries to the teeth (n = 519)

| Type of accident | Percentage |
|-------------------------|------------|
| Fall | 29.9 |
| Fall while playing | 12.5 |
| Fall while walking | 10.0 |
| Fall from high place | 7.3 |
| Collision | 5.2 |
| Collision while playing | 3.6 |
| Collision while walking | 1.8 |
| | |

| | Dental injury | No. dental injury | |
|---------------------|----------------|-------------------|----------|
| | n (%) | n (%) | P-value* |
| Lip coverage | | | |
| Adequate | 145 (39.2) | 225 (60.8) | |
| Inadequate | 71 (48.0) | 77 (52.0) | 0.067 |
| All | 216 (41.7) | 302 (58.3) | |
| Dental caries | | | |
| No | 205 (42.8) | 274 (57.2) | |
| Yes | 10 (27.8) | 267 (2.2) | 0.078 |
| All | 215 (41.7) | 300 (58.3) | |
| SVI | | | |
| 1 | 56 (35.7) | 101 (64.3) | 0.045 |
| 2 | 156 (45.2) | 189 (54.8) | |
| All | 212 (42.2) | 290 (57.8) | |
| Mother's schoolii | | | |
| 13–18 | 22 (51.2) | 21 (48.8) | |
| 7–12 | 127 (36.2) | 224 (63.8) | 0.001 |
| 0-6 | 61 (56.5) | 47 (43.5) | |
| All | 210 (41.8) | 292 (58.2) | |
| SVI, social vulnera | ability index. | | |

Discussion

There was a high prevalence of dental injuries (41.6%) among children between 1 and 3 years of age in the present study. This is in agreement with epidemiological studies on trauma in primary teeth in representative population samples developed in Brazil (3, 7, 8, 14). Although most studies on TDI reveal a greater prevalence of dental trauma among boys (18, 19), no difference between genders was observed in this study. The different age ranges of the studies may have influenced this discrepancy. Activities and psychomotor skills develop during childhood in both genders (20). There were no gender differences in daily activities in the present study.

Enamel fractures and enamel-dentin fractures were the most prevalent types of dental trauma in the present study. Prevalence in different studies varies according to the methodology employed for data collection. In epidemiological prevalence studies, some types of dental trauma are under-reported. This may be because of recording signs and symptoms present at the time of the clinical examination. Injuries frequently found in these

Table 3. Odds ratio (or) unadjusted and adjusted for dental trauma

| Variable | Unadjusted odds ratio (95% CI) | Adjusted odds ratio* (95% CI) |
|---|--------------------------------------|-------------------------------------|
| SVI Low High | 1 1.49 (1.0–2.2)** | 1 1.51 (1.0–2.2)** |
| CI, confidence interval; SVI, social vulnerability index. *Adjusted for gender. ** $P < 0.05$. | | |

studies include enamel fractures and enamel-dentin fractures (2, 3, 18). Many of the children in this study who had suffered dental injuries to the supporting tissues were categorized as 'without trauma', as their injuries left no sign or symptom to be detected during the clinical examination. It is possible to record dental trauma close to the time of occurrence at dental reference or emergency centres such as universities, hospitals and clinics. This may explain the greater prevalence of trauma to the supporting tissues found in this study (19, 21–23). The most frequently affected teeth were the upper central incisors. No difference between the right and left side was found, which is in agreement with other studies (1, 21, 22, 24).

Falls were the aetiological factor with the greatest expressivity for dental injuries, followed by collisions, which is similar to findings from previous studies (1, 21, 25). According to Garcia-Godoy et al. (23) and Gábris et al. (24), the child's home is the location in which dental injuries occur with the greatest frequency, which is corroborated by the present study. This stresses the importance of making parents/guardians aware of measures that can prevent accidents, explaining that greater attention should be paid with regard to the children's physical environment.

In this study, there was no statistical association between dental trauma and dental decay or incompetent lip, but *P* values came very close to significance (*P* = 0.078 for dental decay and *P* = 0.067 for lip incompetence), revealing a tendency in these data. This may be related to the small percentage of the children in the sample who exhibited dental caries (7%) and inadequate lip protection (28.57%).

Dental decay has been associated to dental trauma (10). According to Nguyen et al. (11), children who have finger sucking habits can acquire increased overjet, which is a risk factor for injuries to the upper incisors. However, not all children who exhibit sucking habits will necessary exhibit accentuated overjet. This was observed in a study by Katz et al. (26), in which 60.3% of the children who did not have accentuated overjet exhibited sucking habits.

The socioeconomic variables in this study (mother's schooling and the SVI), were related to the occurrence of dental trauma. These findings corroborate some previous studies carried out in Brazil (12, 27), but not others (2, 13, 14). Such contradictory findings may be related to the different criteria used for socioeconomic classification. The fact that children of mothers with less years of schooling had a greater prevalence of trauma (P = 0.001) may be related to a greater insertion into the job market of mothers with higher levels of schooling, who are therefore able to offer a better quality of life to their children. Furthermore, mothers with greater knowledge regarding health issues make greater efforts to prevent accidents that could compromise the physical, social and psychological wellbeing of their children. The SVI addresses economic factors, housing, schooling, income, jobs, legal assistance and health and nutrition, which may have favoured the statistically significant association to dental trauma. Movsés et al. (27) found similar findings in a study that used the physical

environment, public policy and social cohesion as criteria.

In this study, the prevalence of seeking treatment following dental injury was low in the first 24 h after the injury (4.1%), dropping to just 0.8% after 36 h. According to Osuji (22), this interval can range from 30 min to 5 years. The reason for the under-reporting of dental fractures is the failure to seek treatment because of a lack of knowledge regarding the possible consequences of the injuries on the part of parents/guardians and limited access to dental services in the city of Belo Horizonte for children in the age group studied. A good prognosis and chances of successful treatment are directly related to the time elapsed between the injury and dental care. A number of mothers in this study reported that their children have never suffered dental injury, whereas during the clinical examination, it was observed that 41.7% of the children exhibited signs of dental trauma.

The high prevalence of dental trauma in children at early ages may result in serious damage to the permanent dentition including enamel hypoplasia or a complete malformation of the crown and dental root (21). Such malformations can cause aesthetic, physical and psychological problems for the children. Health-care plans for prevention of dental trauma among children between 1 and 3 years of age are therefore important (14). Knowledge on the distribution of dental trauma in the primary teeth in socially vulnerable regions enables the government to make resources available in order to draft fairer health-care plans for the population.

It is therefore of fundamental importance for paediatric dentists to become involved in public policies so as to assist not only in the establishment of diagnoses and adequate treatment, but also in preventative social measures aimed at health promotion in an effort to reduce the frequency of dental trauma in the primary teeth as well as lessen its financial consequences.

Conclusion

This study found that the prevalence of TDI in primary teeth was high (41.6%) in infants and toddlers between 1 and 3 years of age in Belo Horizonte, Brazil. The results also demonstrated that gender, non-nutritive sucking habits, lack of lip coverage and the presence of caries were not related to the prevalence of TDI. Socioeconomic factors such as mother's schooling and the SVI were significantly associated to traumatic dental injury.

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