

# Prevalence of dental fractures and associated factors in students of Valinhos, SP, Brazil

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## Abstract

**Aim:** To investigate the prevalence of dental fractures and their association with risk factors in the permanent dentition of adolescents in Valinhos, SP, Brazil. **Methods:** The study population was obtained using the probability sampling method and comprised 379 students between 13 and 19 years old enrolled in the eight State schools of the city, who were examined by nine pairs of calibrated dentists (Kappa>0.80). The presence of dental fractures in permanent anterior incisors, as well as the presence of considerable overjet ( $\geq 5\text{mm}$ ) and lip seal was evaluated in a clinical-epidemiological examination. **Results:** The prevalence of dental trauma was 27.1%. The most frequent lesions were enamel fractures (72.6%) of which falls were the main cause (45.7%). No association was found between the presence of considerable overjet and deficient lip seal (chi-square test;  $p>0.05$ ). **Conclusions:** The prevalence of dental trauma in the studied population was expressive when compared with the literature, but the analyzed oral aspects did not contribute to its occurrence.

**Keywords:** dental fractures, risk factors, students, oral health, epidemiology.

## Introduction

The reduction in dental caries worldwide<sup>1-2</sup> in recent years has drawn attention to other aspects of oral health<sup>3</sup>, such as dental trauma<sup>4</sup>, which is a public health issue on the increase<sup>5-6</sup>, making it the second most common cause (after dental caries<sup>7</sup>) of dental treatment.

Epidemiological studies in oral health that include the diagnosis of dental trauma are quite rare compared with data on caries and periodontal disease<sup>6</sup>. Few population-based studies on this subject have been carried out in Latin America, and the majority of the reports come from emergency services, which is not representative of the population<sup>8</sup>. Information could be lost, especially when carious lesions coexist, since the importance of caries prevails over trauma<sup>9</sup>.

The main causes of dental trauma are falls<sup>6,10-11</sup>, activities related to infancy<sup>12</sup>, sports<sup>13</sup>, car accidents<sup>5</sup> and violence<sup>13</sup>. Amongst the biological factors related to an increased risk of dental trauma is an accentuated overjet<sup>8</sup> and an inadequate lip seal<sup>14,14</sup>.

The aim of this study was to investigate the prevalence of dental fractures and their association with risk factors in the permanent dentition of adolescents in a city of the the State of São Paulo, Brazil.

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## Material and methods

A cross-sectional epidemiological survey was carried out in the city of Valinhos, in the state of São Paulo, involving students of both genders, between 13 and 19 years of age, regularly enrolled in the eight schools from the state's public school system ( $n=2,962$ ) in June 2012.

The study followed the regulations established in Resolution 196, 10/10/1996, of the National Health Council of the Ministry of Health, and was carried out with the approval of the Ethics Committee in Research of the São Leopoldo Mandic Dental Research Center (registration number 2012/0127) and with the written informed consent of the parents or guardians.

A probability sampling method was used. Sample size was calculated considering a trauma prevalence of 50%<sup>3</sup>, with its respective 95% confidence interval, 10% accuracy and a 10% non-response rate, with adjustment for finite populations, considering 2,962 individuals in the specified age group in 2011, which resulted in a minimum sample size of 374 students.

The allocation of the sample elements followed the recommendations from the latest National Oral Health Survey, SB, Brazil<sup>15</sup>. The inclusion criteria were: enrolment in the public State school network of Valinhos; age between 13 and 19 years at the time of examination; presence of maxillary and mandibular anterior teeth; and no extensive carious lesions<sup>6</sup>. The exclusion criteria were: student absence on the day of the survey; limited mouth opening; lesions that prevented examination; orthodontic appliances; and one or more maxillary and/or mandibular incisors with a cross-bite or rotation<sup>6</sup>.

Calibration of the examiners for dental fractures was performed using photographs of patients with dental fractures with different degrees of severity. Presence or absence of treatment, overjet measurement and lip seal were calibrated by examining patients. Intra-examiner error was assessed by re-examining 10% of the sample<sup>6</sup>. Inter-examiner agreement was verified using the Kappa test<sup>16</sup>, obtaining a value of 0.80, which was considered adequate for this study.

Data collection was performed by 18 dental surgeons, properly trained and calibrated, divided into 9 groups, each of them with one examiner and one annotator, according to the method used in the National Oral Health Survey, SB, Brazil 2010<sup>15</sup>. Only the criteria for signs of coronal fracture and dental absence of the National Oral Health Survey, SB, Brazil, 2010<sup>15</sup> were used to evaluate the presence of dental trauma. The permanent maxillary and mandibular incisors were considered for the study<sup>15</sup>. The clinical examination was carried out at the schools, during lesson times, under sufficient natural light, with the examiner and patient facing one another. The permanent maxillary and mandibular incisors were examined without drying, using a wooden tongue depressor. All health and safety procedures were strictly followed<sup>15</sup>.

In addition to fractures, the presence of any restorative treatment to the traumatized tooth was also assessed. Patients

with teeth needing treatment were referred to the local healthcare units of the Unified Health System (SUS).

The presence of anterior overjet was assessed as the distance in millimeters between the labial aspect of the most prominent maxillary incisor and the corresponding mandibular incisor<sup>15</sup>. Wooden tongue depressors were used to measure overjet, previously marked at their flat end at 5 mm, with the aid of a millimeter ruler and a pencil. The tongue depressors were then inspected by an independent examiner and then autoclaved.

The student had his/her occlusion positioned in centric relation and the flat end of the wooden tongue depressor was put in contact with the labial aspect of the most lingually positioned incisor. The tongue depressor was placed parallel to the incisal surface at a right angle to the normal arch line. Those who showed coincidental overjet or beyond the mark were classified with "presence of an accentuated overjet". In case of avulsion, the cause of the tooth absence was inquired and included in the trauma prevalence analysis, if it had been the cause.

Lip seal was assessed using the method proposed by O'Mullane<sup>17</sup>, which is defined as the upper lip covering the maxillary incisors at rest. The seal was otherwise considered as inadequate. In order to assess this, the student was instructed to silently read a document, without knowing that he/she was being observed<sup>18</sup>. In cases of doubt, this step was repeated until the examiner was satisfied with the lip position.

All data were collected on a specific form where clinical data, age, gender, etiology and trauma location were recorded. The data were transferred to Excel spreadsheets (Microsoft, Inc, Redmond, Wash) and analyzed using the Bioestat 5.0 software (<http://mamiraua.org/cms/content/public/documents/BioEstat-5.3-Portugues.zip>, free for academic use).

## Results

Four hundred and thirteen (413) volunteers participated in this study, 91.8% fitted in the inclusion criteria ( $n=379$ ), 59.4% females and 40.6% males.

The prevalence of fractures was 27.1%, predominantly in females (59.4%). In terms of marked overjet, the prevalence was 8.3% and inadequate lip seal 13.7%, as described in Table 1.

Table 2 illustrates that 58.4% of the volunteers reminded the etiology and the location where the fractures occurred. Fall was the main cause of fractures, 45.7%, and 50.8% happened during leisure time, whereas 6.8% occurred at school.

From the 101 volunteers presenting dental fractures, 128 teeth were affected, 38.2% involving the permanent maxillary right central incisor, which was the most representative when compared with the other 7 incisors. Enamel fractures (72.6%) had the highest prevalence, with no evidence of pulp exposure or absence of the tooth due to trauma.

Only 17.9% of the fractured teeth had been treated (Figure 1). The permanent maxillary right central incisor was the most frequently treated tooth, representing 56.5% of the

**Table 1.** Absolute frequency distribution (n) of dental trauma in terms of gender, lip seal and overjet.

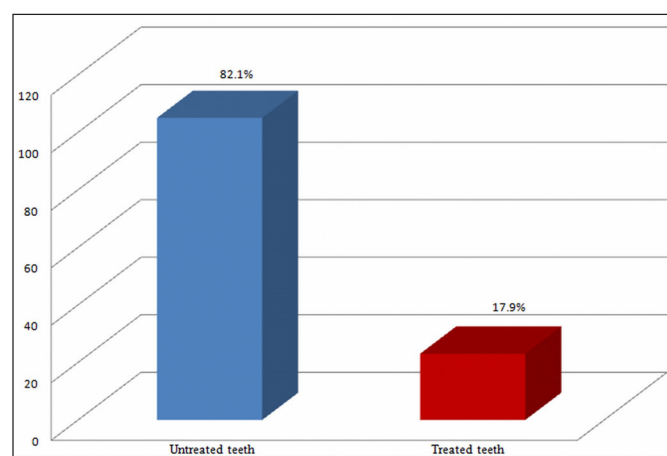
| Gender/Lip seal/Overjet | TRAUMA            |                    |       | p-value <sup>(*)</sup> |
|-------------------------|-------------------|--------------------|-------|------------------------|
|                         | Absence of Trauma | Presence of Trauma | Total |                        |
| Female                  | 162               | 60                 | 222   | 0.95                   |
| Adequate lip seal       | 139               | 50                 | 189   |                        |
| Without Overjet         | 131               | 47                 | 178   |                        |
| With Overjet            | 8                 | 3                  | 11    |                        |
| Inadequate lip seal     | 23                | 10                 | 33    | 0.12                   |
| Without Overjet         | 21                | 7                  | 28    |                        |
| With Overjet            | 2                 | 3                  | 5     |                        |
| Male                    | 109               | 41                 | 150   |                        |
| Adequate lip seal       | 96                | 36                 | 132   | 0.50                   |
| Without Overjet         | 91                | 33                 | 124   |                        |
| With Overjet            | 5                 | 3                  | 8     |                        |
| Inadequate lip seal     | 13                | 5                  | 18    |                        |
| Without Overjet         | 8                 | 3                  | 11    | 0.95                   |
| With Overjet            | 5                 | 2                  | 7     |                        |
| Total                   | 271               | 101                | 372   |                        |

(\*): Chi-squared test.

**Table 2.** Absolute frequency distribution (n) of the etiology and location of dental trauma, according to the gender

| Etiology/Location | Gender |    |       | p-value <sup>(*)</sup> |
|-------------------|--------|----|-------|------------------------|
|                   | F      | M  | Total |                        |
| HOME              | 15     | 10 | 25    | 0.85                   |
| Eating            | 3      | 2  | 5     |                        |
| Collision         | 2      | 2  | 4     |                        |
| Others            | 2      |    | 2     |                        |
| Fall              | 8      | 6  | 14    |                        |
| SCHOOL            | 2      | 2  | 4     | 0.83                   |
| Collision         | 1      | 1  | 2     |                        |
| Fall              | 1      | 1  | 2     |                        |
| LEISURE           | 17     | 13 | 30    | 0.67                   |
| Eating            | 1      |    | 1     |                        |
| Collision         | 5      | 3  | 8     |                        |
| Sports practice   | 4      | 6  | 10    |                        |
| Fall              | 7      | 4  | 11    |                        |
| Total             | 34     | 25 | 59    |                        |

(\*): Fisher's exact test.

**Fig. 1.** Percentage of traumatized teeth with and without treatment.

treated fractures. Restorations involving both dentin and enamel were the most common when compared to enamel restorations only, representing 34.7% and 21.7%, respectively.

There was no association between presence of trauma and gender ( $p=0.95$ ), or between trauma and accentuated overjet ( $p=0.27$ ), or insufficient lip seal ( $p=0.69$ ). However, the association between marked overjet and lip seal was significant ( $p<0.0001$ ).

## Discussion

There are very few reports in the literature regarding dental fractures and the age group evaluated in this study. From the available studies, the fracture prevalence varies from 17.1%<sup>19</sup> to 50.8%<sup>10</sup>, which places the 27.1% encountered in this study within the range. It is likely that such variation in prevalence may be associated to analysis of specific populations, to the sample selection or to the place where the study was conducted.

In a recent National Oral Health study, dental trauma was included and evaluated as a specific measurement in 12-year-old children, which represents an important advancement in establishing a baseline that can be used as an action-planning tool and to determine future targets<sup>2</sup>.

In this study, a predominance of females was encountered. However, the association did not reach significance between genders ( $p=0.95$ ), which is in accordance with the findings of Paiva<sup>6</sup> and Traebert et al.<sup>18</sup> and contrasts with the results of most other studies, which reported a male predominance<sup>5,8,14,20-21</sup>. The gender equivalence may be related to a greater concern of female volunteers in terms of health issues<sup>22</sup>.

The dental fractures reported in this study affected only the coronal portion of the teeth<sup>23</sup>. Most traumas occurred to

the anterior region, mainly the permanent maxillary central incisors, corroborating the findings of a survey carried out with students from Belo Horizonte, MG, Brazil<sup>14</sup>. The most frequent traumatic injury was enamel fracture, confirming the findings from other studies<sup>6,8,10</sup>.

Although trauma prevalence of 10.5%, 15.29% and 19.9% in adolescents has been identified in previous studies<sup>4,5,11</sup> in Valinhos (SP), a high prevalence among the volunteers was demonstrated in this study (27.1%). Among the moment of occurrence of the fractures, leisure time accounted to 50.8% of the cases.

No avulsion was encountered, which agrees with the findings of Paiva<sup>6</sup>. This suggests an association with the location of data collection and may also suggest that avulsed teeth have been replanted, since Valinhos offers adequate access to dental treatment.

The results demonstrated that the main causes of dental fractures were falls (45.7%), followed by collisions (23.7%) and sports (16.9%), which is in line with other studies<sup>6,10-11</sup>.

The relationship between marked overjet and dental trauma was evaluated. This association has been investigated by several authors who reported that individuals with an increased overjet, greater than 5 mm, are significantly more prone to suffer traumatic injuries<sup>4,14</sup>. However, in this study, no significant association between those variables was detected, thus further increasing the disagreement among the results observed in Brazilian studies. Likewise, inadequate lip seal also showed no association with trauma prevalence. However, some authors reported that individuals with inadequate lip protection were more susceptible to dental trauma<sup>4,14</sup>. A possible explanation may be that the lips may absorb part of the impact to the teeth, therefore in cases of adequate lip seal, dental trauma could be less frequent<sup>24</sup>. Conversely, the likelihood of trauma would be higher when inadequate lip seal was detected, due to the lack of lip protection. This, combined with a marked overjet, would further increase the probability of trauma, clarifying the significant association found in this study between overjet and lip seal ( $p < 0.0001$ ).

The lack of information may be responsible for the scarcity of care by health professionals. Appropriate training is needed to deal with affected individuals, in order to develop health promotion strategies that include both treatment and a psychosocial approach to dental trauma<sup>25</sup>. It is also very important that parents and/or guardians have access to information on the best conduct when faced with dental trauma, so that they may be prepared to act appropriately.

The present results indicate that, regarding the prevalence of dental fracture in adolescents in Valinhos, SP, Brazil, a high number of cases with no associated risk factors was observed.

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