Traumatic Dental Injuries in Adolescents from a Town in Southern Brazil: a Cohort Study

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Purpose: To estimate the incidence of traumatic dental injuries (TDI) and determining risk factors in adolescents in Luzerna, Brazil, over a period of three years.

Materials and Methods: A longitudinal study was carried out with adolescents born in 1988 and 1989 attending the schools of the city. Two examinations were performed in the adolescents in the year 2001 and 2004. The sample size was 176 individuals; however, it was decided to invite all 246 students enrolled in 2001. Clinical examinations were carried out through criteria for TDI used in the National Survey, UK, in 1994.

Results: The incidence ratio was of 13.2% (CI 95% 7.9–18.5). The incidence among males was 15.1% (CI 95% 7.6–22.6) and among females 11.0% (CI 95% 3.9–18.1) (p = 0.440) with a relative risk (RR) of 1.38 (CI 95% 0.60–3.14). In relation to increased incisal overjet, the incidence ratio in the exposed individuals was found to be 21.2% (CI 95% 7.3–35.1) and in the non-exposed 11.1% (CI 95% 5.7–16.8) (p = 0.122). Individuals exposed to an increased incisal overjet presented an RR of 1.91 (CI 95% 0.84–4.34). The incidence in the individuals exposed to inadequate lip coverage was 12.5% (CI 95% 2.3–22.7) and in the non-exposed it was 13.4% (CI 95% 7.4–19.5) (p = 0.879). The RR among the exposed was 0.93 (CI 95% 0.36–2.38).

Conclusion: The incidence of TDI was 13.2%. For males, having increased incisal overjet and inadequate lip coverage were not considered as risks factors.

Key words: dental trauma, incidence, incisal overjet, students, trauma

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Traumatic dental injuries (TDI) can be considered an important public health problem of oral origin (Marcenes et al, 1999). There is a relatively high prevalence among adolescents, varying between 6% and 34% (Bastone et al, 2000). TDI have a well-known aetiology (Marcenes et al, 2000) and this therefore offers opportunity for prevention and treatment (Otuyemi, 1994; Hamdan and Rock, 1995).

TDI can have an unfavourable social and psychological impact on the quality of life of children and adolescents when they do not receive adequate treatment (Cortes et al, 2002). This results from the fact that it mainly affects the anterior teeth (Marcenes et al, 2000), causing physical and psychological discomfort, pain, loss of function in chewing and phonation, decreased self-esteem and embarrassment when smiling, therefore having a direct impact on the social life of affected individuals.

The international literature contains various epidemiological studies referring to the prevalence of TDI. Prevalence is an epidemiological concept that represents the ratio between affected people (by TDI, for instance) and the total of the population under investigation. Both exposition and outcome are observed at the same time. In Brazil, studies referring to TDI began in the year 1990, describing the prevalence in the de-

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ciduous dentition (Bijella et al, 1990). However, the first population data related to the permanent dentition are from 2000 (Marcenes et al, 2000).

On the other hand, very few studies of incidence of TDI have been reported. Incidence is another epidemiological concept; however, this means the ratio between new cases (of TDI, for instance) and the population under investigation over a period of time. Incidence can only be measured in longitudinal studies. Only five international studies have been published (Stockwell, 1988; Glendor et al, 1996; Borssén and Holm, 1997; Hamilton et al, 1997; Skaare and Jacobsen, 2003). Stockwell (1988) carried out a study with children through the Australian school dental service, over the course of one year, reporting an incidence of TDI of 1.66%. Glendor et al (1996) based their study on records obtained from public health institutions from a town in Sweden, also covering one year. They noted an incidence of 13 individuals per 1000 individuals per year. Hamilton et al (1997) studied the incidence of TDI over a period of 15 months, in a population in the UK, and found an incidence of 4.2%, making it one of the few studies of incidence with this type of sample. Borssén and Holm (1997) also investigated the incidence in a Swedish town, through the records of the oral public health service, over a period of 14 years, finding an incidence of 28 children per 1000 children per year. Skaare and Jacobsen (2003) studied the incidence in Norway through examinations of children and adolescents in the oral public health service, over a period of one year, reporting an incidence of TDI of 1.8%.

In Brazil only two studies have reported the incidence of TDI. However, one of these was associated with facial trauma and was based on treatment services, reporting that 15.3% of the patients with facial trauma presented an association with TDI (Da Silva et al, 2004). The second study, based on a population, found an incidence of TDI for one group of cases (adolescents with previous TDI) of 11.9% and for a control group (adolescents without previous TDI) of 2.7%, during a period of two years (Ramos-Jorge et al, 2004).

The objectives of this study were to estimate the incidence of TDI and to investigate determining risk factors in adolescents in the city of Luzerna, Brazil, over a period of three years.

MATERIALS AND METHODS

A longitudinal study was carried out with adolescents born in the years 1988 and 1989 enrolled at schools of Luzerna in 2001, when the first clinical examination was performed to diagnose TDI in the permanent dentition. A second examination was carried out in 2004.

The following parameters were used to calculate the sample: the ratio between non-exposed and exposed to increased overjet of 0.3; a relative risk (RR) of 3.0; an estimated incidence in those not exposed of 10%; and a test power of 80% to demonstrate a significant difference between the groups at a significance level of 5%. The total sample consisted of 176 individuals; however, it was decided to invite all the 246 students enrolled in 2001 to compensate for eventual dropouts.

Letters were sent to the city's education and health authorities containing information regarding the importance of carrying out the study, its objectives and requesting authorisation to perform the study. Letters were also sent to the parents or guardians of the children explaining the objective and the characteristics and including a term of authorisation requiring their consent for the participation of their son or daughter in the study. The research project was submitted to and approved by the Committee for Ethics in Research with Human Beings of the Universidade de Passo Fundo, Brazil.

The criteria used for both 2001 and 2004 clinical examination of the adolescents were the same as those in the UK National Survey (O'Brien, 1994). Only the permanent maxillary and mandibular incisor teeth were evaluated. Also evaluated were the type of lip coverage and the size of the incisal overjet. The size of the incisal overjet was measured by the use of a ballpoint type graduated probe. For this measurement, the probe was positioned at the incisal border of the most prominent maxillary incisor up to the vestibular face of the corresponding mandibular incisor, with the size of the overjet being noted in millimeters. The cut-off point for the overjet was taken as 3 mm, based on the systematic review by Nguyen et al (1999). Lip coverage was recorded by asking the adolescent to read a document. The examiner held a document in front of the adolescent, and the latter, remaining seated in their position, read the document to his or herself. When the upper and lower lips touched completely, the lip coverage was considered adequate, and when the upper and lower lips did not meet completely, the lip coverage was recorded as inadequate. The clinical examinations were carried out at the schools with the adolescents seated in a chair, facing a window and under natural light. The examiner used disposable gloves and masks. All biosecurity procedures were rigorously followed.

Ten per cent of sample subjects were examined twice both in 2001 and in 2004 in order to calculate

diagnostic reliability, which was performed using Kappa test in a tooth-by-tooth basis as previously described (Peres et al, 2001).

Those adolescents who were enrolled and examined in 2001 in the schools of Luzerna were located in 2004. Among the adolescents who had changed schools, tracing occurred by means of the student's documentation, obtained from the schools. For those adolescents who had given up their studies, the location was obtained through contact with people related to them, such as friends, neighbours, relatives and teachers.

After locating the adolescents, new letters were sent to the parents or guardians, explaining the objective, the characteristics, and the importance of the study, and containing a term of authorisation requiring their consent for the participation of their son or daughter in the second examination.

For the adolescents who no longer studied at the schools of the city but who had been located in schools of other municipalities, the clinical examination took place at the individual's present school, according to prior arrangements with the governing bodies of these schools. For the adolescents who had given up their studies, the clinical examination was carried out at their place of residence, also after prior notice being given. In these cases, the examination methodology was the same as that used in the schools in Luzerna.

In both the examinations, an examiner, a scribe and a monitor comprised the study team. This team underwent a process of prior calibration, following a methodology described previously (Peres et al, 2001). Following the 2001 and 2004 calibration exercises, two different pilot studies were carried out with students from a neighbouring municipality in the same age range. The results of both showed that the proposed methodology was viable, with no need for modifications.

After carrying out the examinations, the data obtained were entered in the programme EpiInfo 6.04 and analysed by descriptive statistics. The dependent variable was considered to be the occurrence of TDI and variables of exposure were gender, increased incisal overjet and inadequate lip coverage. In order to calculate the accumulated incidence and the RR of exposure of interest, some methodological adjustments were necessary. Of the total of adolescents located and examined, those who already presented some TDI in the examination of 2001 were excluded. A second exclusion process was based on detected differences in the 2001 and 2004 measuring process of variables of exposure. These differences could hypothetically be due to problems of measurement in the collection of information at the two time points of the examination, or alternatively, resulting from treatment, a variable that was not collected.

RESULTS

Intra-examiner reliability was assessed using Kappa coefficient, with values of 0.7 in 2001 and 0.9 in 2004.

In 2001, 233 students born in 1988 and 1989 were examined. Of this total, 196 adolescents were located and examined again in 2004, representing a response rate of 84.9%. The main factor that contributed to the lack of response was the difficulty in locating the adolescent through the means available. Of the total of 196 adolescents, 37 (8.9%) were excluded, resulting in a final sample of 159 adolescents.

The accumulated incidence of TDI during the 3-year period of the study was 13.2% (CI 95% 7.9–18.5). As regards the gender of the subjects, the accumulated incidence was found to be 15.1% (CI 95% 7.6–22.6) among boys and 11.0% (CI 95% 3.9–18.1) among girls ($p = 0.440$). Male individuals had an RR of 1.38 (CI 95% 0.60–3.14) of presenting TDI (Table 1). In relation to the increased incisal overjet exposure, it was found that the incidence among exposed individuals was 21.2% (CI 95% 7.3–35.1) while that among non-exposed was 11.1% (CI 95% 5.7–16.8) ($p = 0.122$). The individuals exposed to increased overjet presented an RR of 1.91 (CI 95% 0.84–4.34) (Table 1). In relation to lip coverage, the incidence among those exposed to inadequate lip coverage was found to be 12.5% (CI 95% 2.3–22.7) while among non-exposed it was 13.4% (CI 95% 7.4–19.5) ($p = 0.879$). The RR among the exposed individuals was 0.93 (CI 95% 0.36–2.38) (Table 1).

Of the total of new cases, 85.7% of the individuals had only one affected tooth and 14.3% had two teeth affected by TDI. In relation to the type of affected tooth, a greater incidence was noted in the upper right central incisor tooth (Table 2).

DISCUSSION

The majority of studies on TDI in children and adolescents are concerned with prevalence and are retrospective. However, studies of incidence can produce more information than those of prevalence (Stockwell, 1988). Few international studies have reported on the incidence of TDI. Among those, the majority report the

Table 1 Incidence of TDI by gender, increased incisal overjet and lip coverage. Luzerna, Brazil, 2001–2004

Variables	n	Accumulated Incidence n (%)	RR (CI 95%)	p
Gender				0.440
Female	73	8 (11.0)	1	
Male	86	13 (15.1)	1.38 (0.61–3.14)	
Overjet				0.122
Up to 3 mm	126	14 (11.1)	1	
More than 3 mm	33	7 (21.2)	1.91 (0.84–4.34)	
Lip coverage				0.879
Adequate	119	16 (13.4)	1	
Inadequate	40	5 (12.5)	0.93 (0.36–2.38)	

Table 2 Incidence of TDI by tooth type. Luzerna, Brazil, 2001–2004 (n = 159)

Tooth	n	%
11	12	7.5
21	8	5.0
12	2	1.5
41	1	0.6
32	1	0.6

Teeth 22, 31 and 42 did not suffer trauma

incidence through studies based in school services, emergency services or patients' records. This can lead to differences in the results found among the diverse studies, due to the analysis of a specific population. In Brazil only two studies have described the incidence of TDI, with only one being population-based (Ramos-Jorge et al, 2004).

The annual average incidence of TDI in this study was 4.4%, while the accumulated incidence over a period of 3 years was 13.2%. The incidence found in this study is high compared with other studies (Stockwell, 1988; Glendor et al, 1996; Borssén and Holm, 1997; Skaare and Jacobsen, 2003). Hamilton et al (1997) observed an incidence of dental trauma of 4.2%, during a period of 15 months, which constitutes a result close to that found in the present study. The incidence of TDI in Luzerna is lower than that reported by Ramos-Jorge et al (2004) in a group of school students with previous TDI (11.9%). The authors showed that adolescents with previous TDI had a 4.9-times greater chance of presenting with new episodes when compared with individuals without previous TDI.

The greater incidence among males found in this study is similar to the majority of previous studies, both those of prevalence (Cortes et al, 2001; Marcenes et al, 2001; Hamdan and Rajab, 2003) and those of incidence (Stockwell, 1988; Glendor et al, 1996; Borssén and Holm, 1997; Hamilton et al, 1997; Skaare and Jacobsen, 2003; Da Silva et al, 2004). Even so, the difference in the incidence between genders was not statistically significant. Some studies of prevalence also have not shown significant differences (Marcenes et al, 1999; Traebert et al, 2003; Soriano et al, 2004). This may reflect the suggestion that the differences in behaviour between boys and girls are decreasing, mainly with regard to the practice of sporting activities and play, in which girls are participating in stronger and rougher activities and playing with toys and equipment with a greater potential for risk, which were previously restricted to boys.

The present study also identified a tendency among individuals exposed to incisal overjet to suffer TDI. Most of the studies of prevalence have reported that individuals with increased overjet are more likely to suffer TDI (Hamdan and Rajab, 2003; Soriano et al, 2004; Marcenes and Murray, 2000; Traebert et al, 2004). However, the incidence between those exposed and not exposed to an increased overjet in the present study was not statistically significant, as also reported in some the studies of prevalence (Marcenes et al, 2000; Marcenes et al, 2001). One of the few studies of incidence that refers to incisal overjet (Ramos-Jorge et al, 2004) states that this was not the principal risk factor for the occurrence of new cases of TDI, but rather it was the presence of previous TDI.

In the present study, inadequate lip coverage was not found to be a risk factor for TDI. Many other previous studies also failed to establish a relationship be-

tween them (Marcenes et al, 2000; Marcenes et al, 2001; Traebert et al, 2004). Once again, the only study of incidence that reports on lip coverage is that by Ramos-Jorge et al (2004), which states that this was not the main risk factor for the occurrence of new cases. In Luzerna, unexpectedly, the risk of TDI occurring among those exposed to inadequate lip coverage was lower than among those not exposed.

This unexpected finding, together with the non-significant differences in incidence between gender and individuals exposed to increased overjet, may be related to the limitations of this study. One of the main limitations concerns the low number of individuals analysed. This was due to dropouts during the process of locating the adolescents and the need to exclude individuals who were located and examined, but who could not be included in the analysis. This exclusion was necessary in order to avoid bias related to the study design, in which the collection of information referring to eventual treatments for increased incisal overjet and inadequate lip coverage, during the interval of the examinations was not performed. Thus, it was impossible to consider the time of contribution of the exposures to the occurrence of the studied outcome.

Regarding the number of teeth affected by TDI per individual, this study found a greater incidence involving only one traumatised tooth (11.3%). This result is in agreement with Stockwell (1988) who reported a greater proportion of children with only one traumatised tooth. Glendor et al (1996) also reported a higher percentage of individuals with injuries in only one tooth.

In relation to the type of tooth affected, a greater incidence was found in the right maxillary central incisor, in agreement with a study by Stockwell (1988) who reported a higher proportion of injury to the maxillary central incisors (71.9% of the cases). Glendor et al (1996) also noted the central incisors as the teeth most affected by TDI (73%), although they did not specify to which dental arch they belonged. Borssén and Holm (1997) reported the maxillary central incisors as the teeth most affected by injuries, representing 67% of cases.

As alternatives for the reduction of cases of TDI, public health workers and policy makers should include incentives towards the use of oral protectors during the practice of sporting activities, especially those that involve physical contact among the participants. In addition, the use of safety equipment in leisure activities that involves the use of bicycles, skateboards and skates and the creation of safe environments both for the practice of sports and for other leisure activities is fundamental. Another strategy in the prevention of TDI could be incentives to schools to include in their curriculum the development of health promotion programmes for students.

Also, the possibility of social assistance for adolescents mainly in developing countries is important in order to reduce the levels of physical violence, both in the home and elsewhere.

Finally, as studies have used different classifications and methodologies to define TDI, variation in the results is likely to occur. For this reason, a standardised classification would be useful since it would make the studies easier to perform and enable the comparative analysis among these studies.

It can be concluded that the incidence of TDI in Luzerna over a period of 3 years, was 13.2%. For boys, having increased incisal overjet and inadequate lip coverage were not considered as risks factors. New, well-conducted cohort studies should be carried out in order to confirm these results.

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