

Preterm birth does not increase the risk of traumatic dental injuries or unintentional injuries

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ABSTRACT

Aim: To evaluate the prevalence of traumatic dental injuries (TDI) and unintentional injuries (UI) in Swedish children from 0 to 12-years-of-age, comparing those who were born preterm with matched full-term controls. The associations between TDI and UI and medical health problems or socio-demographic characteristics were also studied.

Methods: This cross-sectional, case-control study used dental record reviews and interviews to obtain TDI data on 187 matched pairs aged from 0 to 6 (Sample I) and a structured questionnaire to study TDI and UI among 82 matched pairs from 0 to 12-years-of-age (Sample II).

Results: Reports of TDI in the primary baby teeth and permanent adult teeth from 0 to 12-years-of-age were significantly more common in the control than preterm born children ($p=0.032$). No significant differences were seen in the 0 to six age group. When it came to UI, there were no statistical significant differences between the preterm and control groups and no correlations between TDI and UI and medical health problems or socio-demographic characteristics.

Conclusion: The study indicates that preterm children are no more exposed to TDI or UI than matched full-term controls. In fact, the control group parents reported significantly higher prevalence of TDI in the primary and permanent teeth.

Keywords: Traumatic dental injuries, unintentional injuries, preterm children, paediatrics,

Key Notes

- This study evaluated the prevalence of traumatic dental injuries (TDI) and unintentional injuries (UI) in Swedish children from 0 to 12-years-of-age, comparing 269 matched preterm and full-term pairs.
- Using dental reviews, interviews and questionnaires, we found that preterm children did not have more problems with TDI or UI than the matched full-term controls.
- The control group parents reported a significantly higher prevalence of TDI in the primary and permanent teeth.

Introduction

Traumatic dental injuries (TDI)

Traumatic dental injuries (TDI) pose a considerable burden for children, families and public health services. They are the most common orofacial injuries and are more likely to happen in the first ten years of life (1). Prevalence varies from 9% to 37% in the primary teeth and from 4% and 59% in the permanent teeth (1), with figures affected by factors such as age, sex, nationality, region, socioeconomic level, diagnostic criteria and study design. A third of all preschool children have suffered a TDI to their primary teeth, together with a quarter of older children with permanent teeth (1). TDI is more common in boys (1).

The main risk factors for TDI in permanent teeth are dental overjet with protruding incisors, environmental factors, human risk-taking factors, illness, cerebral palsy, learning difficulties and physical limitations (2).

General unintentional injuries (UI) are a health burden for the child and family and an economic burden for society, due to the costs of injury prevention, treatment and rehabilitation. (3). The main causes include traffic accidents, drowning, poisoning and falls (4).

A broad range of chronic health conditions in five-year-old children has been associated with increased risk of child injury (5). Characteristics such as anxiety and disruptive behaviour have also been associated with injury during childhood (6, 7), including attention deficit hyperactivity disorder (ADHD) (7). It has also been established that preterm children and children with low birth weights have a high frequency of chronic health conditions and cognitive disturbances (8, 9) including learning deficits (10, 11). This suggests that preterm children should be regarded at potential risk of UIs, including TDI. Furthermore, there are

reports on deficits in fine and gross motor development persisting into adolescence (12) and on neuropsychiatric disorders such as ADHD (13) being more frequent in preterm and very low birth weight children. The cluster of deficits seen in preterm children may increase the risk of TDI. However, the association between TDI and low birth weight and preterm birth has not, to our knowledge, been studied.

The aim of the present study was to evaluate the prevalence of traumatic dental injuries (TDI) and unintentional injuries (UI) in Swedish children from 0 to 12-years-of-age, comparing those who were born preterm with matched full-term controls. In addition, the associations between TDI and UI and medical health problems, immigrant background and maternal education level were evaluated. Two separate groups of preterm children were studied, with the results being based on a review of dental records and interviews (n=187) and questionnaire data (n=82), respectively. Comparisons were made with the same numbers of matched full-term children.

The main hypotheses tested were:

- Preterm children have a higher prevalence of TDI in their primary and permanent teeth and a higher prevalence of UI than full-term children.
- Preterm children with medical health problems face an elevated risk of TDI or UI, when compared with preterm children without medical problems and healthy full-term controls.

Materials and methods

Subjects

The study was carried out in southwest Skåne in southern Sweden. According to official statistics, the country's two main cities are Malmö, the third largest city in Sweden with approximately 300, 000 inhabitants, and Lund, with approximately 111, 000 inhabitants.

Sample I (aged 0 to 6)

Preterm children were identified to take part in a series of studies on dental behavioural management problems (14, 15, 16). The study population included all children born between 23 and 32 weeks of gestation between 1994 and 1996 at the university hospitals of Lund and Malmö in southern Sweden (n=192). The Swedish National Board of Health and Welfare granted access to the Swedish Medical Birth Register, where information on the children's gestational age, birth weight and number of siblings was collected. For each child born preterm, a control child, born after at least 37 weeks of gestation, was matched for age, sex, immigrant background (at least one parent born outside the Nordic countries), dental clinic and dental operator.

In total, 187 of the 192 preterm children participated, as four parents declined and one dental record was missing. Of these, 144 were very preterm, born between 29 and 32 weeks of gestation, and 43 were extremely preterm, born between 23 and 28 weeks of gestation (17, 18). In addition, 187 matched controls were included.

The parents of 26 of the preterm children refused to take part in telephone interviews for unknown reasons and seven preterm children were excluded because of intellectual disabilities. We were unable to contact the parents of one preterm and one control child to discuss medical health problems and unable to contact the parents of four preterm and three control children to discuss immigrant background and maternal education.

Sample II (aged 0 to 12)

The Sample II preterm children (24 to 32 weeks gestation) took part in an earlier clinical study of Molar-Incisor Hypomineralisation and have previously been described in detail (19). Born between 1997 and 1999 at the university hospitals in Lund or Malmö, they lived in Malmö in 2009 and were identified through the Swedish Medical Birth Register, which

provided information on gestational age, birth weight and number of siblings. Although 98 preterm children satisfied the inclusion criteria above, 14 of the parents declined and two were not reachable, leaving 82 preterm children. Of these, 62 were very preterm and 20 were extremely preterm.

The controls, born after at least 37 weeks of gestation, were matched for age, sex and immigrant background (at least one parent born outside the Nordic countries) and were included consecutively from the patient list at the Department of Pediatric Dental Clinic at the Faculty of Odontology, Malmö University. All the controls agreed to participate and the study group comprised 82 matched pairs.

Procedures

Sample I – subjected to dental record review and interview

One of the authors (SBR) examined the dental records from 0 to six-years-of-age and collected the following data and notes on TDIs:

- a) Whether the child had experienced any TDI
- b) Personal data, including gender and age at the time of the injury
- c) Total number of TDIs
- d) Total number of dental visits for TDI (dental visits for other reasons were excluded).

Information about medical health, including chronic illness and general health problems, were obtained from telephone interviews. These were conducted with the parents by one of the authors (SBR), when the children were eight to 10-years-old. The specific questions concerning the preschool period have previously been reported by Brogårdh-Roth et al (15). Information about the child's immigrant background (at least one parent born outside the Nordic countries) and the mother's level of education were obtained from a follow-up interview. We used Westbom and Kornfält's (20) definition of chronic illness: 1) a disorder

that is disabling and obviously chronic or incurable or (2) a disorder that lasts for at least three months during a one-year period, interferes with daily life functioning and/or needs treatment or special aids for at least three months or (3) a disorder that requires hospitalisation for at least one month or at least three periods over the course of one year. General health problems were defined as medical problems of lesser severity or duration, such as allergies or minor respiratory disorders. Medical health problems were defined as the child having chronic illness and/or general health problems.

The mother's level of education was divided into low level, defined as just compulsory school education (≤ 9 years), and high level, defined as high school/university level (≥ 10 years).

Sample II – subjected to questionnaire

Along with the clinical examination (19), the accompanying parent filled in a structured questionnaire covering the child's experience of TDIs and UIs. TDI questions were adopted and modified from Rowe et al 2007 and Glendor 2008 (1, 7) and the definition of TDI was based on a question modified from Glendor 2008 (1): *Has there been a dental trauma incident? (in this study, specifically during the period from 0 to 12-years-of-age)*. The definition of UI was modified from Rowe et al 2007 (7): *Has there been any unintentional injury like bumps and bruises, cuts or other injuries like broken bones, burns, crushed fingers, animal bites, etc, but excluding dental trauma? (in this study, specifically during the period from 0 to 12-years-of-age)*. Possible answers were yes or no. The parents were also asked to answer yes or no to whether they had been any injuries (included those where dental or medical treatment was, or was not, sought) of hospitalisation of \geq one day.

Injuries were based on the World Health Organization (WHO) definition: *“acute exposure to physical agents such as mechanical energy, heat, electricity, chemicals and*

ionizing radiation interacting with the body in amounts or at rates that exceed the threshold of human tolerance” (4). Injuries were classified as unintentional injuries and intentional injuries. Unintentional injuries (UI) was based on the WHO definition and included road traffic injuries, falls, drowning and submersion, contact with heat, poisoning and exposure to inanimate and animate mechanical forces (4). TDI was excluded from the definition of UI.

The questionnaire also covered items including chronic illness and general health problems, according to Westbom and Kornfält (20). Information on the mother’s level of education and immigrant background was also included in the questionnaire and defined as in Sample I.

Ethics

The Ethics Committee of the Medical Faculty of Lund University approved the study format (review of dental records and interviews, Dnr LU 362-01, questionnaire, Dnr 449/2008).

Written information, including information on full confidentiality and the right to withdraw at any time, was posted to the families, with a maximum of two reminders. Written informed consent form was obtained from parents for the review of dental records and interviews (14, 15) and from the parents and children for the questionnaire (19).

Statistical methods

McNemar’s test for matched pair comparisons were used to compare the differences between the preterm and control groups for gender, child’s immigrant background and very and extremely preterm children. Chi-square or Fisher’s exact test were used to compare the remaining subgroups between, and within, each group.

Differences in the mean number of TDI appointments and total number during pre-school years were tested using Student’s t-test for paired observations. The Statistical

Package for the Social Sciences (SPSS), versions 16.0, 18.0 and 20.0, were used for all analyses and P-values ≥ 0.05 were regarded as not statistically significant.

Results

Sample I – based on dental record reviews and interviews

Traumatic dental injuries (TDI)

The characteristics of both groups are given in Table 1. A total of 374 dental records (187 matched pairs) were examined for prevalence of TDI in the primary teeth from 0 to six-years-of-age. Additional information on medical health was obtained from telephone interviews (153 preterm children and 153 controls), as show in Table 2, with information on immigrant background and maternal education level from a follow-up telephone interview (150 preterm children and 151 controls).

Of the 187 preterm children, 11 had severe disorders such as cerebral palsy, syndromes and intellectual disabilities. These children were included in the dental record review, which showed no TDI in their primary teeth, but seven with intellectual disabilities were excluded from the interviews. None of the control children had disabilities.

No statistically significant differences were seen between the groups when it came to TDI in their primary teeth (Table 2) or with regard to the subgroups of sex, singletons/twins, medical health problems, immigrant background and maternal educational level. The only statistical difference to emerge from the subgroup analyses within the groups were control children with, and without, medical health problems (31.3% vs. 11.6%, $p=0.007$).

The mean number of dental appointments for children with TDI was non-significant at 2.4 for the preterm group (SD=1.67, range one to six visits) and 2.0 for the control group

(SD=1.22, range one to eight visits). The total mean number of TDI was also non-significant at 1.3 for the preterm group (SD=1.52, range 1-3) and 1.0 for the control group (SD=0.18, range 1-2).

Sample II – based on questionnaire

Traumatic dental injuries (TDI)

The characteristics of both groups are given in Table 1. The participation rate was 84%, none of the children had any type of disability and their mean age when the questionnaire was completed was 11.3 (range, 9.8-12.9 years) for the 82 preterm children and 11.3 (range, 9.5-12.9 years) for the 82 control children.

Table 2 shows that there were significantly more TDIs reported to the primary and permanent teeth between 0 to 12-years-of-age by the control children ($p=0.032$). The subgroup comparisons between the two groups showed higher prevalence of TDI in the control children, with significant differences regarding singleton and multiple births (50.6 % vs. 30.8%; $p=0.025$) and higher and lower maternal education level (higher 57.7% vs. 36.8%; $p=0.006$). No statistically significant differences were noted in the subgroup analyses within the two groups.

Regarding TDI severity, 22 of control children (53.7%) and 19 of the preterm children (73.1%) sought dental treatment, a non-significant difference.

Unintentional injuries (UI)

No statistically significant differences were revealed between both groups when it came to UIs (58.5% vs. 52.4%; $p=0.473$) (Table 2) and the subgroup analyses showed no significant differences between, or within, the groups.

Table 1. Characteristics of preterm children (PT) and full-term controls (C). Sample I: Subjected to dental record review and interview. Sample II: Questionnaire.

	Sample I (n=187)		Sample II (n=82)	
	PT	C	PT	C
Age of the child	0-6	0-6	0-12	0-12
Very preterm (VPT)	144		62	
Extremely preterm (EPT)	43		20	
Sex				
Boys	98 (52.4%)	98 (52.4%)	42 (51.2%)	42 (51.2%)
Girls	89 (47.6%)	89 (47.6%)	40 (48.8%)	40 (48.8%)
Twins or triplets	55 (29.4%)	1 (0.5%)	30 (36.6%)	3 (3.7%)
Immigrant background				
Nordic	153 (81.8%)	153 (81.8%)	39 (47.6%)	39 (47.6%)
Immigrant	34 (18.2%)	34 (18.2%)	43 (52.4%)	43 (52.4%)
Medical health problems*	60 (38.9%) ¹	32 (20.9%) ²	37 (45.1%)	20 (24.4%)
Mean gestational age in weeks (range)	30 (23-32)	≥ 37	30 (24-32)	40 (37-43)
Mean birth weight in grams (range)	1,436 (604-2,430)	no data available	1463 (470-2480)	3472.9 (2540-4970)

* Statistical differences between PT and C children in sample I, $p=0.001$, in sample II, $p=0.009$ (McNemar's test)

¹ total n=153 ² total n=153

Table 2. Prevalence of traumatic dental injuries (TDI) and unintentional injuries (UI) in preterm children (PT) and full-term controls (C). Sample I based on dental record review and Sample II on questionnaire.

Variable	PT	C	Significance
No. of individuals			
TDI – prevalence - Sample I			
Total (187/187)	30 (16.0%)	31 (16.6%)	<i>p</i> =1.000
VPT (144/144)	24 (16.7%)		
EPT (43/43)	6 (13.9%)		
Significance	<i>p</i> =0.671		
Boys (98/98)	16 (16.3%)	20 (20.4%)	<i>p</i> =0.585
Girls (89/89)	14 (15.7%)	11 (12.4%)	<i>p</i> =0.664
Significance	<i>p</i> =0.912	<i>p</i> =0.139	
TDI prevalence – Sample II			
Total (82/82)	26 (31.7%)	41 (50.0%)	<i>p</i> =0.032
VPT (62/62)	17 (27.4%)	33 (53.2%)	
EPT (20/20)	9 (45.0%)	8 (40.0%)	
Significance	<i>p</i> =0.142	<i>p</i> =0.304	
Boys (42/42)	15 (35.7%)	22 (52.4%)	<i>p</i> =0.210
Girls (40/40)	11 (27.5%)	19 (47.5%)	<i>p</i> =0.115
Significance	<i>p</i> =0.424	<i>p</i> =0.659	
UI prevalence – Sample II			
Total (82/82)	48 (58.5%)	43 (52.4%)	<i>p</i> =0.473
VPT (62/62)	39 (62.9%)		
EPT (20/20)	9 (45.0%)		
Significance	<i>p</i> =0.158		
Boys (42/42)	25 (59.5%)	23 (54.8%)	<i>p</i> =0.824
Girls (40/40)	23 (57.5%)	20 (50.0%)	<i>p</i> =0.549
Significance	<i>p</i> =0.852	<i>p</i> =0.666	

Regarding UI severity, 27 of the preterm children (56.3%) and 34 of the control children (79.1%). reported the need to seek medical treatment and, of these, 10 of the preterm children (37.0%) and 16 of the control children (47.1%) were hospitalised for \geq one day as a result of the UI, a non-significant difference.

Discussion

This study showed that the preterm children were not exposed to TDI or UI more often than the matched full-term controls. In fact, the parents of the control children reported a significantly higher prevalence of TDI in their primary and permanent teeth, disproving the proposed hypotheses that preterm children face an increased risk of TDI and UI and that medical health problems pose risk factors for TDI and UI.

This study was population-based and had a cross-sectional, case-control study design. Although the two samples sizes were limited, participation rates were high, with 97% of dental records reviewed and 82% of interviews completed in Sample 1 and 84% of questionnaires completed in Sample 11. The main aims of the study were to assess the prevalence of TDI and UI in a population of preterm and matched full-term control children and to investigate whether TDI and UI were associated with medical health problems and sociodemographic characteristics. Although preterm children reportedly have complications that imply lifelong consequences for their health, growth and development, including hyperactivity disorder (21-24), the present study did not reveal any predisposition to TDI or UI in this group. As far as we know, this study is the first to analyse these injuries in preterm children, so it is not possible to compare our more detailed findings with other studies.

Our study found that 16.0% of the preterm group and 16.6% of the control group sustained TDIs to their primary teeth and this figure agrees with European epidemiological studies (1),

including one that reported a prevalence of 18% in a similar age group of three to five years, based on information from dental clinics.

In Sample I, almost 6% of the preterm children suffered from disabilities, but none of them had experienced TDI to their primary teeth. There are few studies describing the prevalence of TDI in disabled individuals, but one recent study confirmed that TDI is not common in primary teeth (25). This may be because disabled children acquire motor skills and act independently at a later age than children without disabilities. No children with disabilities were identified in Sample II.

The significantly higher prevalence of TDI in the control group was an unexpected finding. One possible explanation is that preterm children are at lower risk of accidents, as they are less likely to take part in organised leisure activities, as reported in a previous study of 11-year-old preterm children (10). Other studies have suggested that preterm children face an increased risk of developing poor socialisation skills (10, 24, 26, 27), which may result in withdrawn behavior and low self-confidence and restricted participation in recreational sport activities. Another study discussed different parenting styles and the fact that children vary in personality and temperament. It pointed out that children with hyperactive and impulsive behavior, often reported in preterm children (28), need to be more closely supervised by parents than their peers, suggesting that these children are protected from exposure to potential injury risks (5).

The literature presents wide variations in the prevalence of UI, due to outcome measures such as mortality or morbidity and registered incidence or prevalence of UI, as well as differences in study populations, regions or methodological approaches. Therefore, as in the case of TDI, it is difficult to compare the results of our survey with others. One recent review showed that the most significant variables associated with UI were sex, age and

socioeconomic status (29). In addition, a Swedish study agreed with other international studies that children of mothers with lower education were consistently at higher risk of injuries leading to hospitalisation (30). These correlations were not seen in the present survey, possibly owing to the small sample sizes of the preterm and control subgroups.

To summarise, the present study did not reveal any differences in the prevalence of TDI or UI between the preterm and full-term control children. In fact, according to their parents, the control children experienced TDI more often than the preterm children. Further research, based on larger sample sizes, is needed to study the prevalence of TDI and UI in various preterm subgroups in greater detail.

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