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Primary tooth injuries in Norwegian children (1–8 years)

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Abstract – This prospective study examined the yearly incidence of traumatic injuries to primary teeth. The aim of the study was to find out more about dental injuries to primary teeth in Norwegian children. The study was performed in one county of Norway involving approximately 20 000 children in the age group 1–8 years. Twenty-seven public dental clinics and 42 dentists participated. The dentists attended information and calibration meetings and received illustrations of the classification of dental trauma as well as examples of how to fill in the forms correctly. Two hundred and sixty-six children were involved, including 447 primary teeth, recorded during a 1-year registration period (2003). The dental trauma incidence was 1.3% with 3.5-year old being the most accident-prone. Boys were significantly more often injured than girls, 164 versus 102 ($P < 0.001$). The upper central incisors were most involved (92%), with a non-significant difference between the right and left side. The minor periodontal injuries dominated (59%). Hard tissue injuries were far less frequent (13%). Avulsions were observed in 6.5% and intrusions in 7.5% of the injured children, being 5.5% and 5% of the injured teeth. Most of the injuries occurred either at home (38%) or at kindergarten (32%). Sixty-two percentage were falling accidents often sustained during children's play, and 25% were pure playing accidents. Conclusion: In Norwegian children aged 1–8 years, with a predominance of boys, the most common primary tooth injuries were minor luxations of the maxillary central incisors, sustained at an age of 3.5 years. As the traumas often occurred during children's play and/or were the consequence of falls, these are difficult to prevent. However, follow ups should be carried out to disclose pulpal or periodontal complications and/or developmental disturbances of the permanent successors.

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Although injuries to the primary teeth are frequently seen by Norwegian paediatric dentists' exact information regarding incidence, preferred treatment and prognoses is not present.

Most international epidemiological studies are retrospective, with a reported frequency of 12–35% (1–5). This great variation in prevalence may either be due to differences in patient selection methods, injury registration procedures, or the diagnostic criteria applied. Several studies include a selective patient material, being either referrals to a specialist/emergency clinic (6–8), comprising a specific age range (9), constituting only a selection of diagnoses (10), or the study may have involved both primary and permanent teeth (3, 7, 11–13).

Prospective studies, on the other hand, have the advantage that the data are collected at the time of injury (14). Thus, fewer injuries are missed during data collection, resulting in more reliable population frequency estimation. It was therefore decided to carry out a prospective study on dental injuries in the primary dentition of Norwegian 1–8-year-old.

Since the main reason for treatment of primary tooth injuries is to diminish developmental disturbances to the permanent successor, the aim of the present study was twofold: (i) to find out more about the incidence and diagnosis of dental injuries in the primary dentition, and (ii) to study the outcome for both the injured primary teeth, and for the permanent successors.

The present article will document baseline information on primary tooth injuries, whereas the outcome for both the primary and permanent dentition will be presented in a later paper following the eruption of the permanent teeth in this study group.

Materials and methods

Participants

All new trauma episodes affecting primary teeth in the age group 1–8 years were recorded in the county of Buskerud during a 1-year period (January 1, 2003–December 31, 2003). This county represents both geographic and demographic variations. A total of 42 dentists employed in the public dental health service participated in this prospective study. Registrations took place in 27 clinics in five out of seven dental districts in the county. In total 20 300 children, born 1995–2002, are living in these five dental districts (15).

The public dental health service in Norway offers free dental care from birth to 18 years of age, and thus all, or almost all dental injuries are registered in the public clinics. Private dental practitioners participated only when the patients were seeking acute dental care outside regular clinic hours. These injuries were subsequently registered in the public clinics.

Registration of injuries

A standardized trauma record, which the dentists were familiar with, was used. An additional registration form was developed for analysis of the data. All the participating dentists attended information and calibration meetings. The dentists also received illustrations of the classification of dental traumas and examples of how to correctly complete the forms. For each patient the involved teeth, diagnosis, soft tissue injury, as well as place of event were to be recorded.

The classification was visualized by drawings and text for 16 different diagnoses based on WHO's classification system modified by Andreasen and Andreasen (16). Nine diagnoses were injuries to the hard dental tissues and the pulp, and seven diagnoses involved injuries to the periodontal tissues. Each diagnosis was coded with a letter. More than one diagnosis was recorded with a combination of the letters.

Injuries to the hard dental tissues and the pulp
Crown fractures, A: infraction, B: fracture involving enamel, C: fracture involving enamel and dentine, D: fracture involving the pulp. *Crown-root fractures*, E: uncomplicated (pulp not involved), F: complicated (pulp involved). *Root fracture*, G: cervical 1/3, H: middle 1/3, I: apical 1/3.

Injuries to the periodontal tissues
J: concussion, K: subluxation with horizontal mobility, L: subluxation with horizontal and vertical mobility. M: extrusive luxation, N: lateral luxation, O: intrusive luxation, P: avulsion.

In addition, injuries without a definite diagnosis, that is soft tissue injury only or discolouration known to have occurred during the registration year, were also included. In the data analysis, discolouration was incorporated in the category of periodontal injuries without displacement (group J). The dentists were also asked to record the cause of injury and the place of event.

The study is approved by the Norwegian Data Inspectorate. The data were analysed using the Chi-square test in the statistical analysis program SPSS Version 11. The level of significance was set at 5%.

Results

Age and sex distribution

A total of 266 children suffered an oral injury during the year of registration, whereby 164 were boys and 102 were girls. Three girls and one boy were injured twice. The age range was 9 months to 7 years and 11 months, all born during 1995–2002. Four children were less than 1 year (two were 9 months and two 11 months) and five children were between 7 and 8 years at the time of injury. The dental trauma incidence was 1.3% for the whole material (1–8 years), 1.7% for the age group 1–6 years and 2.5% for the age group 3–4 years. The majority (75%) of the children were injured at the age range 2.5–5.5 years, and the 3.5-year old were the most accident-prone

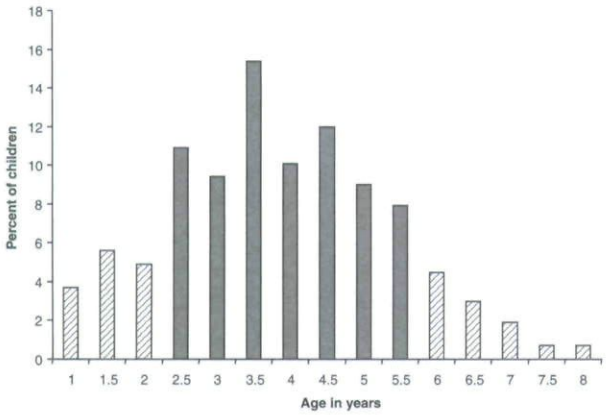

Fig. 1. The percentage distribution of children related to age at the time of injury.

(Fig. 1). The mean and median age was 3.9 and 3.8 years, respectively.

Boys outnumbered girls within all age groups, and this difference was statistically significant ($P < 0.001$) (Fig. 2). Furthermore, the boys more often than the girls had a history of a previous trauma, 18 versus 12%.

Injured teeth

As an individual may have had more than one injured tooth, the number of injured teeth ($n = 447$) was higher than the number of registered accidents ($n = 266$). Most of the children (89%) had either one (47%) or two (42%) injured teeth. The maxillary central incisors were most often affected (Fig. 3), and 92% of the accidents involved one of the upper central incisors.

The left-hand side was more often affected than the right side, but this difference was not statistically significant.

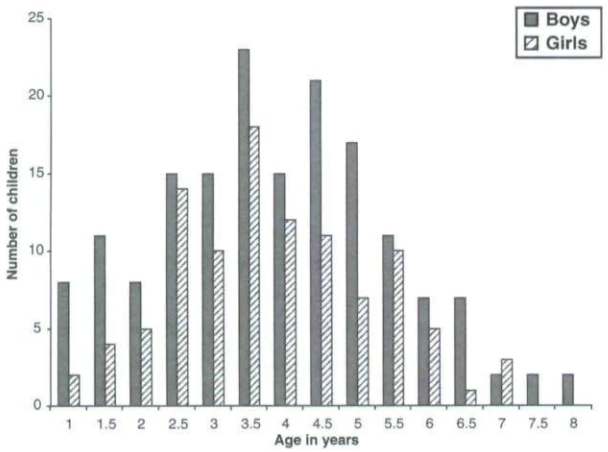

Fig. 2. The distribution of accidents related to age and sex.

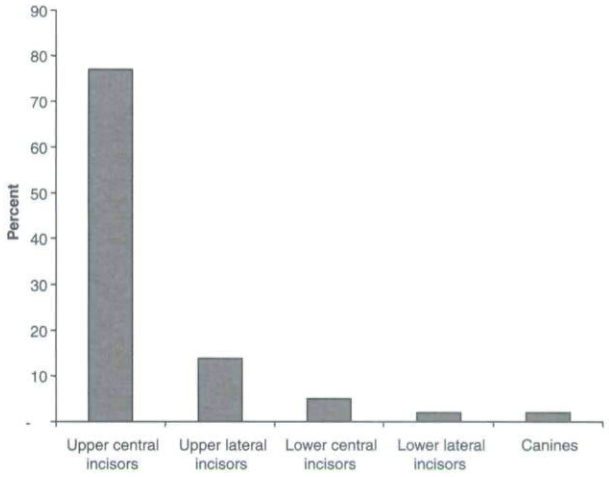

Fig. 3. The percentage distribution of injuries for the traumatized teeth ($n = 447$).

Injuries to the periodontal tissues

The majority of the injuries (81%) involved the periodontal tissues (Fig. 4). The mild periodontal injuries, subluxations and concussions, dominated and represented 59% of all the diagnoses. The severe traumas, those with displacement, constituted 22% of the diagnoses involving 29% of the children (Table 1).

The severe periodontal traumas were distributed throughout all ages, but a lower mean age was observed for the intrusive luxations (mean = 3.2 - years) and a higher mean age for the extrusive

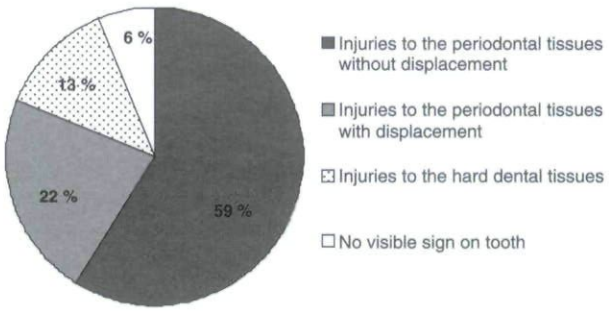

Fig. 4. The percentage distribution of diagnoses.

Table 1. The number of children experiencing periodontal injuries with displacement

Severe periodontal injuries	Male	Female	No. of children	Children (%)	Mean age in months
Extrusive luxation	7	4	11	4	63
Lateral luxation	17	13	30	11	48
Intrusive luxation	13	7	20	7.5	38
Avulsion	6	11	17	6.5	53
Total	43	35	78	29	

luxations (mean = 5.3 years) than for the material as a whole. However, in contrast to the other traumas, the mean age for the avulsion injuries differed between the sexes. The mean age in boys was 3.7 years and in girls 5 years. Moreover, whereas boys dominated in all other diagnostic categories, the girls experienced avulsion injuries significantly more often than the boys. Eleven girls avulsed 14 teeth whereas six boys avulsed eight teeth ($P < 0.02$).

Injuries to the hard dental tissues and the pulp

Hard tissue injuries were far less frequent than periodontal injuries, 13 versus 81% (Fig. 4). In this group, the uncomplicated crown fractures (enamel and enamel-dentin fractures) dominated, representing 8.5% of all the diagnoses. Only 1% involved the pulp.

In 16 children (6%) there was no visible sign on the tooth and no diagnosis could be made. These children were typically of low age and had soft tissue injuries.

Etiology

The most common etiological factor was unspecific falling accidents (63%), often sustained during children's play, while 25% were pure playing accidents. Furthermore, the accidents were evenly distributed between home (38%) and kindergarten/school (32%), whereas in 17% the place of event was unknown.

Discussion

In the present prospective study, the yearly trauma incidence in the age group 1–8 years was 1.3%. This is comparable with the observations of Glendor et al. (14) who reported an incidence of 1.5% in the age group 0–6 years (1.7% in the 1–6-year old in the present study). Whereas the highest frequency of traumas was observed at 3.5 years in the present study, Glendor et al. (14) found 2-year old to be the most accident-prone. However, the present incidence peak corresponds well with other Scandinavian studies (1–3, 17).

The above-mentioned discrepancy in age peak may be due to the method of age determination. This estimation may either be based on the year of birth or on the actual age in months/years at the time of injury. If the year of birth is the starting point, a registered 2-year old may be close to 3 years. This may explain the difference in the findings of Glendor et al. (14) compared with the present study, although Glendor et al. did observe that the 3–4-year old were more often injured than the 1–2-year old. Furthermore, in a recent Brazilian preschool population the largest percentage of injuries was demonstrated in 3 to 4-year-old children (5). Thus, the incidence peak may seem to be at an older age than previously reported (18). Another explanation for the reported high frequency of traumas in the very young children may be patient selection (6, 8, 9) or the fact that the parents' of the youngest age group may be more concerned and thereby seek dental care more readily.

The significance of this age discussion is that a higher mean age at the time of primary tooth injury may be favourable for the permanent successor since the crown is not completed until about 4 years of age.

Whereas hard tissue injuries are more commonly seen in the permanent dentition, luxation injuries occur more frequently in the primary dentition (1–3, 9, 12, 15, 17). Mild periodontal injuries, those without displacement, dominated in the present study representing more than half of all the injuries. This is also in agreement with other studies (2, 3, 8, 14), although there is a divergence with respect to the reported severity of the periodontal injuries (1, 11). Other authors, however, claim that hard tissue injuries dominate in the primary dentition (4, 5, 13). This difference may partly be due to the study design and/or the classification system used. In some surveys registering prevalence of traumatic injuries, the minor periodontal injuries (concussion and subluxations) are overlooked (5) based on the fact that they often heal without complications or have no signs of a previous trauma. The present prospective study made it possible to set a correct diagnosis at the time of injury explaining the high number of mild periodontal injuries. Furthermore, in Norway the public dental health service offers regular, free dental care, and almost all injuries, including the minor traumas, is likely to be registered. Thus, in 6% of the children seeking dental care there were no visible signs on the tooth.

The high number of periodontal injuries and the low frequency of hard tissue injuries are most likely related to the more elastic alveolar bone and periodontal ligament in young children. A progressive root resorption and the shorter roots of deciduous teeth present during preschool age may also account for a favouring of luxation injuries rather than hard tissue fractures.

Confirming other studies (2, 3, 11, 13, 14), the present study showed that boys sustained injuries more often than girls in all age groups, although there are some reports showing an equal sex distribution (4, 5, 8). This higher incidence of injuries found among boys than girls may be explained by more vigorous play. In addition, the

boys in the present study also more often had a history of a previous trauma.

Furthermore, boys' experienced intrusive luxations twice as often as girls and the mean age were lower in both sexes (3.2 years) than for the other injuries. The energy of an impact causing such a severe injury may reflect the time when the child starts running or exploring its surroundings without the necessary coordination. This may increase the risk of severe trauma. As mentioned, an important aspect regarding primary tooth injuries is the consequence for the permanent successor, and at 3 years of age the mineralization of the permanent incisors is still not fully completed.

In contrast to the intrusive luxations, the extrusions were seen on average 2 years later, probably due to the fact that the incisor roots have started to resorb.

Whereas boys dominated in all other trauma categories, the girls significantly more often experienced avulsions and these at an older age, mean age 5 versus 3.7 years. Why this age difference exists is not known, but again a more forceful play at an earlier age may be an explanation.

Our results confirm that falls, often in combination with play, were the most common etiological factor, and these deciduous tooth traumas are consequently difficult to prevent. Most traumas occurred either at home or in the kindergarten, both indoor and outdoor, and in nearly half of the children only one tooth was injured, comparable with the findings of Glendor et al. (14).

In conclusion, the bulk of the dental injuries in this study were mild, affecting the upper central incisors, at an age of 3.5 years. The boys sustained injuries significantly more often than girls, but girls suffered avulsions more often than boys and these occurred at an older age.

In aiming to minimize developmental disturbances in the permanent dentition, the most effective methods are firstly to obtain an exact diagnosis, then to provide correct first-aid treatment and lastly to perform regular follow ups until the permanent successor has erupted.

References

1. Andreasen JO, Ravn JJ. Epidemiology of traumatic dental injuries to primary and permanent teeth in a Danish population sample. Int J Oral Surg 1972;1:235–9.
2. Forsberg CM, Tedestam G. Traumatic injuries to teeth in Swedish children living in an urban area. Swed Dent J 1990;14:115–22.
3. Borssén E, Holm AK. Traumatic dental injuries in a cohort of 16-year-olds in northern Sweden. Endod Dent Traumatol 1997;13:276–80.
4. Hargreaves JA, Cleaton-Jones PE, Roberts GJ, Williams S, Matejka JM. Trauma to primary teeth of South African pre-school children. Endod Dent Traumatol 1999;15:73–6.
5. Kramer PF, Zembruski C, Ferreira SH, Feldens CA. Traumatic dental injuries in Brazilian preschool children. Dent Traumatol 2003;19:299–303.
6. Llarena del Rosario ME, Acosta Alfaro VM, Garcia-Godoy F. Traumatic injuries to primary teeth in Mexico City children. Endod Dent Traumatol 1992;8:213–4.
7. Caldas AF Jr, Burgos ME. A retrospective study of traumatic dental injuries in a Brazilian dental trauma clinic. Dent Traumatol 2001;17:250–3.
8. Cardoso M, de Carvalho Rocha MJ. Traumatized primary teeth in children assisted at the Federal University of Santa Catarina, Brazil. Dent Traumatol 2002;18:129–33.
9. Cunha RF, Pugliesi DM, de Mello Vieira AE. Oral trauma in Brazilian patients aged 0–3 years. Dent Traumatol 2001;17:210–2.
10. Fried I, Erickson P, Schwartz S, Keenan K. Subluxation injuries of maxillary primary anterior teeth: epidemiology and prognosis of 207 traumatized teeth. Pediatr Dent 1996;18:145–51.
11. Onetto JE, Flores MT, Garbarino ML. Dental trauma in children and adolescents in Valparaiso, Chile. Endod Dent Traumatol 1994;10:223–7.
12. Altay N, Güngör HC. A retrospective study of dento-alveolar injuries of children in Ankara, Turkey. Dent Traumatol 2001;17:201–4.
13. Kargul B, Çağlar E, Tanboga I. Dental trauma in Turkish children, Istanbul. Dent Traumatol 2003;19:72–5.
14. Glendor U, Halling A, Andersson L, Eilert-Petersson E. Incidence of traumatic tooth injuries in children and adolescents in the county of Västmanland, Sweden. Swed Dent J 1996;20:15–28.
15. Statistics Norway. Population sorted by sex and age. http://statbank.ssb.no/statistikkbanken/ (read 11.03.2004).
16. Andreasen JO, Andreasen FM. Textbook and color atlas of traumatic injuries to the teeth, 3rd edn. Copenhagen: Munksgaard; 1994: pp. 151–5.
17. Borum MK, Andreasen JO. Sequelae of trauma to primary maxillary incisors. I. Complications in the primary dentition. Endod Dent Traumatol 1998;14:31–44.
18. Flores MT. Traumatic injuries in the primary dentition. Review. Dent Traumatol 2002;18:287–98.