Dentoalveolar trauma in Glasgow: an audit of mechanism and injury

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Abstract - Traumatic dental injuries in children often require multiple follow-up visits to the dentist and may have long-term consequences for the developing dentition. The aim of this audit was to examine age, gender, location, time of year, mechanism of injury and type of injury sustained in relation to dentoalveolar trauma in children attending the paediatric dental trauma clinic at Glasgow Dental Hospital from 2002 to 2004, and to compare our findings with data in the published literature. Males suffered 60% of all dental trauma, 79% of sporting injuries and 85% of assaults. The injuries in males were more severe, representing 65% of enamel dentine and pulp fractures, 100% of crown root fractures and 66% of crown root and pulp fractures. A peak for trauma was seen in the 8-11-year-old group (43%). The majority of injuries in the under four age group resulted from falls (87%). Taken as a whole, falls accounted for 49%, sports related injuries 18%, bicycle and scooter 13%, assault 7%, and road traffic accidents 1.5% of all injuries. They also accounted for a far higher percentage of intrusive luxations (67%). The largest proportion of injuries occurred during the summer months (33%). Sixty-four percent of children suffered trauma to more than one tooth. Fiftyeight percent of injuries involved the dental hard tissues and pulp and the majority of these (82%) were crown fractures. Most subjects (82%) suffered trauma to their periodontal tissues. (26%)concussion or subluxation, 26% lateral luxation and 23% avulsion). Injuries to the supporting bone were uncommon. Sixtysix percent of all injuries occurred outdoors. Our findings were similar to a number of published studies, but in contrast to several others. More consistency is required in the collection and reporting of trauma data to be able to draw meaningful conclusions by comparison.

Graeme Wright¹, Aileen Bell², Gregor McGlashan¹, Carolyn Vincent¹, Richard R. Welbury¹

¹Department of Paediatric Dentistry; ²Department of Oral Surgery, Glasgow Dental Hospital and School, Glasgow, UK

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Richard R Welbury, Department of Paediatric Dentistry, Glasgow Dental Hospital and School, Glasgow, UK Tel.: 0044 (0) 141 2119665 Fax: 0044 (0) 141 3312146 e-mail: r.r.welbury@dental.gla.ac.uk Accepted 10 August, 2005

Traumatic dental injuries often require multiple follow-up visits and may have long-term consequences for the developing dentition. It is therefore an important area for research. However, of the studies that exist, many report on the prevalence of trauma with less emphasis on the mechanism of injury and few give a full profile of the children involved and the time and place of injury. The aim of the audit was to examine the records of a large group of children in an attempt to build a profile of the children themselves (including gender, and age at the time of injury) and to assess the location, time of year, mechanism of injury and type of injury sustained. This knowledge would be able to inform planning decisions for the staffing of emergency dental services.

Materials and methods

A retrospective cross-sectional survey was carried out on a group of children who attended the trauma clinic at Glasgow Dental Hospital and School between 2002 and 2004. Data was collected from case records using computer readable data collection sheets. Information gathered included patient gender, age at the time of trauma, geographic location of traumatic event, time of year, mechanism of trauma and type of injury sustained. Mechanism of injury was divided into: sports, road traffic accident (RTA), falls, bicycle and scooter related, assault and other. The types of injury were divided into those affecting periodontal tissues, dental hard tissues and pulp, and supporting tissues (Table 1).

Periodontal injuries comprised concussion and subluxation, lateral luxation, intrusive luxation, extrusive luxation and avulsion. The dental hard tissues and pulp injuries comprised enamel or enamel and dentine fracture (uncomplicated crown fracture), enamel dentine and pulp fracture (complicated crown fracture), crown root fracture (uncomplicated crown root fracture), crown root and pulp fracture (complicated crown root fracture), and root fracture (Table 2).

Results

Social, geographic and seasonal demographics

A total of 398 case records were available for analysis. The gender distribution of dental trauma was weighted towards the male population with 239 (60%) of males suffering injuries. As the population

Table 1.	Mechanism	and	type	of	injury
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Mechanism of injury	Type of injury				
Sports Road traffic accident Falls Bicycle & scooter Assault Other	Periodontal tissues Dental hard tissues and pulp Supporting tissues				

Table 2. Subdivision of injury type

Periodontal tissue	Dental hard tissue	Supporting		
injuries	and pulp injuries	tissue injuries		
Concussion	Enamel fracture	Alveolar fracture		
Subluxation	Enamel and dentine fracture	Dento-alveolar fracture		
Lateral luxation	Enamel, dentine and pulp fracture			
Intrusive luxation	Crown root fracture			
Extrusive luxation	Crown, root and pulp fracture			
Avulsion	Root fracture			

age increased, so did the proportion of male to female trauma with males 2.7 times more likely to suffer injury compared with their female counterparts.

The incidence of trauma was also found to increase steadily with age up to a peak in the 8–11-year age group; 72 (18%) were in the under four age group; 91 (23%) in the 4–7 age group; 171 (43%) in the 8–11 age group; and 64 (16%) in the 12–15-year age group.

The incidence of trauma had a seasonal variation: 92 cases (23%) of trauma occurred from January to March; 107 (27%) from April to June; 131 (33%) from July to September; and 68 (17%) from October to December. The peak therefore being seen over the summer months in this northern hemisphere location.

Mechanism of injury

The incidence of each mechanism of injury is shown in Fig. 1. Sports related injuries occurred in 73 (18%) cases, road traffic accidents in 6 (1.5%), falls in 197 (49%), bicycle and scooter related injuries in 51 (13%), assault in 27 (7%) and other modes in 51 (12%) of all injuries. (One example of 'other mode' was being struck in the face whilst playing with a fire hose!). Clearly the most common mechanism of injury was falls (Fig. 1).

Single/multiple tooth

A total of 143 (36%) subjects suffered trauma to one tooth, whilst the majority, 255 (64%) suffered trauma to more than one tooth.

Type of injury

A total of 230 (58%) subjects suffered some form of injury to the dental hard tissues and pulp i.e.



Fig. 1. Mechanism of injury.

enamel, dentine, pulp or root fractures. The majority of these, 189 (82%) were coronal fractures, including those with and without pulpal involvement.

A total of 326 subjects (82%) suffered trauma to their periodontal tissues: 85 (26%) suffered concussion or subluxation; 84 (26%) lateral luxation; 75 (23%) avulsion; 49 (15%) intrusive luxation; and 33 (10%) extrusive luxation.

Injuries to the supporting bone were relatively uncommon, with only nine subjects (2%) suffering a dentoalveolar fracture.

Correlations

The mechanism of injury was correlated against the patient's age and gender, the time of year of injury, whether the injury occurred indoors or outdoors, the type of periodontal injury, the type of hard tissue injury, the type of supporting bone injury and whether the injury affected one or more teeth. This is shown in Table 3. These and other correlations are described under the following headings:

Gender vs mechanism of injury

Falls were by far the most common cause of dental trauma, occurring in 195 (49%) of all subjects. There was little variation between the sexes, with falls resulting in 129 (54%) of injuries to males and 73 (46%) to females. With males accounting for 58 (79%) sporting injuries, and 23 (85%) assaults, these were predominantly male orientated mechanisms. One recorded mechanism of trauma, which was more prevalent in the female population was bicycle and scooter injuries [5 (10%) of injuries in males vs 8 (15%) in females].

Gender vs type of injury

There was a tendency for injuries in males to be more severe, with 37 (65%) enamel dentine and pulp fractures, 5 (100%) crown root fractures and 6 (66%) crown root and pulp fractures occurring in males.

Age vs mechanism of injury

The vast majority of injuries in the under four age group, 62 (87%), resulted from falls. Although not as marked in other age groups, falls were overall the most common cause of injury in all groups with the exception of the 12- to 15-year olds. In this group, 19 (30%) injuries were sports related, 17 (27%) were because of falls and 16 (25%) occurred as a result of assault. It is notable that 24 (89%) assault related injuries occurred in the older half of the population (8–15-years old) (Fig. 2).

		Road				
		traffic		Bicycle/		
	Sports	accident	Falls	scooter	Assault	Other
	(%)	(%)	(%)	(%)	(%)	(%)
Age						
0–3 years	3	0	29	2	4	9
4–7 years	17	16	23	31	7	28
8–11 years	52	68	39	55	26	53
12–15 years	28	16	9	12	63	10
Gender						
Male	78	33	56	49	85	58
Female	22	67	44	50	15	42
Time of year						
January–March	27	0	23	16	30	21
April–June	24	17	26	33	32	27
July–September	33	33	31	45	19	35
October–December	16	50	20	6	19	17
Periodontal injury						
Concussion/subluxation	33	12.5	23	30	22	23
Lateral luxation	12	12.5	7	7	16	12
Intrusive luxation	7	12.5	23	17	0	13
Extrusive luxation	29	12.5	25	23	39	27
Avulsion	19	50	22	23	23	25
Dental hard tissue injury						
Enamel and dentine fracture	47	50	68	61	33	64
Enamel, dentine and	31	50	19	31	20	14
pulp fracture						
Crown and root fracture	3	0	3	0	0	0
Crown, root and	6	0	2	Ō	13	4
pulp fracture						
Root fracture	13	0	9	9	32	18
Supporting tissue injury		•	•	•		
Alveolar fracture	100	100	60	0	100	100
Dento-alveolar fracture	0	0	40	0	0	0
Single/multiple	-	-		-	-	-
Single	46	0	38	23	9	40
Multiple	54	100	62	67	91	60
Location	• •			••	•••	
Indoors	49	100	46	2	10	90
Outdoors	51	0	54	98	90	10
		-				



Fig. 2. Age vs mechanism of injury.

Age vs type of injury

The 8–11-year age group accounted for 167 (42%) of all injuries. This group suffered 128 (56%) of all dental hard tissue and pulp injuries, 18 (63%) root fractures and 38 (50%) avulsions. The under four age group accounted for 72 (18%) of all injuries, and

in particular accounted for 8 (10%) of avulsions and 22 (44%) of intrusive luxations. The 12- to 15-year olds accounted for 64 (16%) of all injuries, while experiencing only 3 (5%) intrusive luxations, they sustained 13 (42%) of extrusive luxations.

Time of year vs mechanism of injury

Thirty three percent of all injuries occurred in the summer months of July to September. The majority 22 (45%) of these were bicycle and scooter related. There was less trauma from October to December (18%) and bicycle and scooter incidents were responsible for only 3 (6%) of these injuries (Fig. 3).

Geographic location of injury vs mechanism of injury

A total of 265 (66%) of all injuries occurred outdoors: 52 (67%) sporting injuries; all road traffic accidents; 108 (53%) falls; 21 (89%) assaults; and 60 (98%) bicycle injuries. Interestingly one bicycle injury (2%) was indoors, and was because of the bicycle falling onto a subject in their bedroom!

Mechanism of injury vs type of injury

Sports injuries accounted for 73 (18%) cases of all trauma, and specifically 3 (5%) intrusive luxations, 8 (10%) avulsions, 33 (22%) enamel and dentine fractures, and 22 (36%) enamel, dentine and pulp fractures.

Falls accounted for 195 (49%) of all injuries, and 21 (34%) enamel, dentine and pulp fractures and 39 (67%) intrusive luxations.

Primary and secondary dentition vs type of injury

Trauma to the primary dentition accounted for 76 (19%) injuries in comparison to 322 (81%) involving the permanent dentition. However, 120 (37%) of all the injuries to the periodontal tissues involved the primary dentition (Fig. 4). The permanent dentition suffered 220 (96%) of injuries involving the dental hard tissues and pulp.

Discussion

The gender distribution within this sample was weighted towards the male population at a ratio of



Fig. 3. Time of year vs mechanism of injury.



Fig. 4. Injuries to the periodontal tissues of the primary and secondary dentitions.

1.5:1. A number of previous studies have given disparate findings on the gender distribution of dental trauma, with Kramer et al. (1) describing males and females being equally affected whilst Canacki et al. (2), Tapias et al. (3), Skaare et al. (4) and Rajab et al. (5) found a male to female ratio ranging from 1.8:1 to 2.18:1.

The incidence age peak of traumatic injuries in this sample was in the 8–11-year-old age group. The reported peaks of age related to dental trauma vary from study to study, with some authors presenting a peak age group such as Wood et al. (6) (6–10 years), whilst others report peak age simply in single years such as Gabris et al. (7) (10 years of age). It is clear that there is such considerable variation in the grouping of ages and in the sampling methods for inclusion in study cohorts in the scientific literature that it is not possible to make a simple and direct comparison between studies. However, the general trend of age distribution in the literature mirrors that seen in our sample, with peaks of trauma having previously been reported at 8-10, 11 and 10-12 age groups. (Saroglu et al. (8), Rajab et al. (5), Skaare et al. (4).

We have found a clear peak in the incidence of dental trauma during the three summer months (33%) in this northern hemisphere study. This difference was also noted by Altay et al. (9) in their sample of 246 dental injuries in Turkish children (54% spring/summer vs 46% winter/autumn). This seasonal variation is in contrast to the study of Da Silva et al. (10) who found peaks in the months of October (15%) and March and June (13% each), when looking at dental trauma in Brazilian children (10). However, it is important to take into account that the variation in temperature between the seasons are not as great in Brazil in comparison to Turkey and the UK.

The largest single cause of dental trauma in our study population was because of falls. This concurs with the findings of Tapias et al. (3) in Spain (46%), and Rajab et al. (5) in Jordan (49%). Further studies

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of geographically diverse populations, have looked at the incidence of the mechanism of injury and have found contradictory rates, with Skaare et al. (4) finding that sports and assault related injuries in Norway each accounted for 8% of dental injuries. Canacki et al. (2) found in a study based in Turkey, that falls accounted for 27%, while assault 24%, sports 18% and road traffic accidents 11% were the other major categories.

In contrast to the findings of Zaragoza et al. (11) and Rajab et al. (5) where the majority of dental trauma affected only one tooth, (69% and 75% respectively), our sample suffered dental trauma more commonly to multiple teeth (64%).

A total of 58% of all injuries were to the dental hard tissues and pulp, with 82% of these being crown fractures. This incidence is almost identical to the findings of Kramer et al. (1), who found an incidence of 83% of injuries related to crown fractures in their cohort of 1545 children.

Whilst we found that some of the mechanisms of dental trauma, assaults for example, are weighted towards the male population, others such as falls have no gender bias. There is little published data making correlations between the mechanisms of dental trauma and gender and therefore it has not been possible to draw comparisons on this subject.

We have seen that the male patients within our sample suffered more severe dental injuries. However, despite several reports looking at types of injury and at age related to injury Borssen et al. (12), Glendor et al. (13), Gassner et al. (14), Locker et al. (15), there appears to be no reported direct correlations between gender and type of dental injury sustained.

The most marked findings when correlating age to mechanism of injury were that 87% of children under 4 years of age suffered dental trauma because of falls whilst 89% of dental trauma because of assault was suffered by those aged over 9 years of age. This latter finding echoes the work of Zerfowski et al. (16) who reported that in adolescents, over 60% of injuries were a result of an assault or altercation.

When comparing the type of injury sustained in comparison to the age of the patient, there is a clear delineation in the injuries when comparing the younger to the older patient. Our findings are not entirely unexpected, in that those aged under 4 years of age are more likely to suffer from intrusive luxations (44%) which could be explained by both the elasticity of the supporting bone and the prevalence of falls in this age group. In addition to this, the 12- to 15-year olds only experienced 5% of intrusive luxations but suffered a high number of extrusive luxations (42%). Despite the fact that the findings do not appear unusual, they do not appear to have been reported previously in the literature.

There has been no published data on the correlations between the time of year and the mechanism of injury, nor the geographic location of trauma in respect to the mechanism of injury. There has also been no direct comparison between the mechanism of injury and the injury sustained, however, our data clearly gives an indication as to the incidences of injuries in relation to their causative factors (Table 3).

Given the difficulty in making direct comparisons between the variety of confounding factors in relation to the epidemiology of dental traumatology, it would seem that dental traumatology researchers would benefit not only from an agreed uniformity in the collection of their data, but also in the way that the data is reported. This would enable more accurate planning of future dental trauma services.

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