

## Oral trauma in children

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### Abstract

*Through the use of a new trauma form, the incidence of various types of oral trauma were reported at The Children's Hospital Medical Center and two private pedodontic offices. During a one-year period, 338 cases of oral trauma were treated. The major cause of the trauma seen involved falls of various types. Sports and bicycle accidents accounted for a number of injuries as well. The number of traumatic injuries was highest in September, correlating with the beginning of the school year. The majority of the traumatic injuries were fractures, and most frequently involved permanent teeth. Displacement injuries, however, involved a higher proportion of primary teeth.*

**T**he incidence and prevalence of traumatic dental injuries has been documented in many studies. The majority of these studies report statistics on fractured anterior teeth only. These reports are generally retrospective, examining given populations for past history of traumatic injury.

Epidemiological investigations suggest that the incidence of fractured teeth varies greatly depending on the population under study with regard to age, sex, and the fracture classification system utilized. In one of the earliest studies, Ellis reported that 4.2% of his sample of 4,251 secondary school children experienced fractures of the incisor teeth.<sup>1</sup> Grundy documented a 5.1% frequency of tooth fracture in a study of children 5-15 years of age. The Ellis Class I fracture type was the most prevalent. This was also one of the few studies which included a survey of primary, as well as permanent tooth fractures.<sup>2</sup> In a sample of 1,166 patients, Gutz reported a significantly higher frequency of coronal fracture (20.24%).<sup>3</sup> Zadik, in one of the largest studies to date, examined 10,903 patients. He found an 8.7% prevalence of fractured an-

terior teeth.<sup>4</sup> A more recent study conducted by Macko concurs with the higher prevalence reported by Gutz; that population experienced a 19.1% fracture frequency.<sup>5</sup>

Other factors which are reported often include differences in fracture, prevalence between sexes, and variation in the age at which fractures are most likely to occur. All of the above studies report a higher frequency of anterior tooth fracture among males. The most common age for tooth fracture was reported to be 8-10 years by most investigators.<sup>2,3</sup>

Few studies have addressed the prevalence of other types of traumatic injuries in addition to anterior tooth fracture. Ravn conducted a five-year epidemiological study in Copenhagen, which recorded all traumatic injuries sustained over this time.<sup>6</sup> He reported a male/female ratio of 1.6:1 with the largest number of injuries occurring in the 8 to 9-year age group. While 70% of the injuries recorded involved anterior tooth fracture, the incidence of luxation, exarticulation, and subluxation also were reported. The various causes of traumatic incidents were computed and the seasonal variation of traumatic incidents was noted.

The current investigation is a prospective study designed to determine the relative frequency of various oral traumatic injuries, etiologic factors, seasonal variation, and potential target populations.

### Methods and Materials

The present study was conducted at the Boston Children's Hospital Medical Center and two private pedodontic offices from January 1 through December 31, 1979. All dental emergencies during this period were coded on a special dental trauma form specifically designed to yield clear and concise reports of the traumatic episode. The form insured accurate data, as well as easy statistical compilation. Information on

the patient's age, sex, and time and cause of injury was recorded. Any previous trauma to the involved teeth also was noted. A diagram of the anterior dentition, both permanent and primary, was included so that a drawing of the tooth injury could be recorded easily. The patient's occlusion, overbite, and overjet were documented. The trauma form was so well accepted by the staff, that is now in permanent use at the clinic and in private staff offices. It is important that pediatric dentists develop trauma forms for their own use. Numerous examples can be found in the literature.

At the time of presentation a complete medical history was obtained. The time of the accident and the time of arrival at the clinic were noted. A brief history of the incident was recorded and thorough extraoral and intraoral soft tissue examinations were performed. Information regarding tetanus inoculations was recorded and pertinent and appropriate action taken. All lacerations and contusions were noted and drawn on the form.

Following each incident of oral trauma, the child's dentition was examined for fracture, displacement, mobility, discoloration, and tenderness. Mobility was recorded using a three-point grading scale. Tooth fractures were drawn on the form and classified using the standard Ellis classification. A Class I fracture indicates involvement of enamel only; Class II fractures involve enamel and dentin; and Class III fractures involve enamel, dentin, and the pulpal tissue. All root fractures were grouped together in this study.

Displacements were classified according to the direction of movement — labial, lingual, mesial, or distal. Avulsions and intrusive injuries were treated as separate classifications. Those dental injuries resulting in no displacement, but exhibiting mobility were grouped as subluxation injuries. Alveolar and jaw fractures were listed separately. Other classification systems for traumatic injuries have been developed by both Andreasen and Johnson.<sup>7,8</sup> It was felt, however, that the shortened Ellis classification was the simplest and easiest to use in the current clinical study.

The direct cause of any traumatic injury is at times difficult to discern. For the purpose of the present investigation, the injuries were classified using the

following six groups: falls, sports, bicycles, fights, accidents, and car accidents.

Radiographic examinations were performed in nearly all cases in which trauma had been sustained. In those cases involving very young children, efforts were made to obtain adequate radiographs where possible.

Treatment modalities were recorded in a step-by-step manner to allow for easy review of the prescribed treatment. Home care instructions were given, and a follow-up clinic appointment was made when necessary.

## Results

During the 12-month period from January 1 through December 31, 1979, a total of 338 traumatic injuries were treated.

The breakdown of injuries according to cause revealed that 62% were the result of various types of falls (59% of falls occurred indoors; 41%, out-of-doors). Sport accidents accounted for 13% of injuries. Bicycle accidents resulted in 12%, and fighting between children accounted for 8% of the trauma. (Fighting was a distinct group from the fall classification or the accident group.) Injuries which occurred by chance — being hit by an opening door, for example — were classified as accidents and resulted in 3% of all traumatic injuries. Car accidents accounted for 2% of the oral trauma. The only cause noted in this study which could not be classified in the above categories was a single case of child abuse (Table 1).

The seasonal variation of traumatic injuries was classified by month. The highest incidence of oral trauma was seen in the months of September and October. A graphic representation of seasonal trauma distribution is shown in Table 2.

The "accident prone" child is mentioned often in trauma literature.<sup>6</sup> The frequency of individuals who had sustained previous traumatic injuries was 17%. The child was recorded as having a prior traumatic injury only if the same teeth were involved in the previous trauma. No attempt was made to record other previous injuries.

A large number of cases involved soft tissue injuries. Of these, extraoral soft tissue injuries were present in 46% of all presenting patients. Intraoral injuries were present in 49% of all trauma cases. Subluxation injuries were defined as those injuries in which tooth mobility was present without displacement. The incidence of subluxation was 40%. Of these patients, 56% had more than one tooth involved. A total of 264 subluxated teeth were recorded; 50% involved primary teeth and 50% involved permanent teeth.

Luxations were classified as those injuries involving displacements of the traumatized teeth. These injuries accounted for 28% of all reported cases. The majority of the cases, 64%, involved only one luxated

TABLE 1. Cause of Oral Trauma

Cause	Number of Trauma Cases	Percentage of all Trauma
Falls	209	61.8
Sports	44	13.0
Bicycles	42	12.0
Fights	27	8.0
Accidents	9	3.0
Car accidents	6	2.0
Child abuse	1	0.2

TABLE 2. Seasonal Variation of Trauma

45--								41				
40--									36			
35--				34								
30--			27	33			27					29
25--		26					26					
20--					20					23		
15--	16											
10--												
5--												
	January	February	March	April	May	June	July	August	September	October	November	December

tooth. Primary teeth accounted for 72% of all luxation injuries; only 28% involved permanent teeth.

Intrusive injuries accounted for 7% of all reported trauma. The majority of these cases (65%) involved only one intruded tooth. Primary teeth were involved in 85% of the cases.

Traumatic injuries involving avulsed teeth accounted for 8% of all reported cases. In 61% of the injuries only one avulsed tooth was involved. Of these avulsions, 66% involved primary teeth.

Tooth fractures were the most common type of traumatic injury, and resulted in 42% of all reported cases. A single fractured tooth was involved in 65% of these incidents. Permanent teeth accounted for 70% of all fractures.

The fracture cases were divided according to fracture type, using the Ellis classification system. Twenty-two per cent of fractures of permanent teeth were Class I fractures, 61% were Class II fractures, and 12% were Class III fractures. Root fractures involved only 5% of the fractured permanent teeth. Thirty-five per cent of fractured primary teeth were Class I fractures, 25% were Class II fractures, and 18% were Class III fractures. Root fractures were present in 23% of fractured primary teeth. These results are summarized in Tables 3 and 4.

**Discussion**

This investigation differs from the majority of trauma studies in the types of traumatic injuries recorded and the population under study. The patients involved ranged in age from 13 months to 19 years.

TABLE 3. Frequency of Traumatic Injuries by Type

Injury	N	%	Teeth Involved			
			Permanent		Primary	
			N	(%)	N	(%)
Subluxation	134	(40%)	132	(50%)	132	(50%)
Luxation	96	(28%)	41	(28%)	103	(72%)
Intrusions	23	( 7%)	4	(15%)	22	(85%)
Avulsions	28	( 8%)	13	(34%)	25	(66%)
Fractures	143	(42%)	140	(70%)	59	(30%)

TABLE 4. Fracture Classification

Ellis Fracture Class	Teeth Involved			
	Permanent		Primary	
	N	%	N	%
I	31	(22%)	21	(35%)
II	85	(61%)	14	(24%)
III	17	(12%)	11	(18%)
Root	7	( 5%)	13	(23%)

Trauma statistics have been recorded infrequently in children younger than six years. Most trauma studies are retrospective and have utilized school-age populations. As a direct result, the prevalence of fractured incisors has been the most documented type of injury. The prospective nature of this study has permitted the accumulation of incidence rates of various types of traumatic injuries involving a population base of varying ages.

Falls of various types accounted for 62% of the trauma, sports and bicycle accidents accounted for 25%, and fights and other accidents caused only 13% of the total injuries reported. The present investigation is in agreement with trauma studies of a similar nature in Copenhagen.<sup>6</sup> The largest numbers of oral trauma cases were reported in September and October with a relatively small number seen in January and May. This correlates with the beginning of the school year. A study by Ravn confirms September as the month during which the greatest number of traumatic injuries occur.<sup>6</sup>

A number of different types of oral trauma were examined. Extraoral or intraoral soft tissue injuries were present in half of all trauma cases. It was twice as likely that a single tooth (vs. multiple teeth) was involved in trauma except for the subluxation injuries. In this injury class, slightly more cases involved multiple subluxations.

The most common traumatic injury was the fractured tooth. Numerous studies have reported the prevalence of fractured teeth in a school population.<sup>1-6</sup> The present investigation utilized a population which presented with traumatic injuries, and comparison of prevalence rates between this study and previous reports would therefore be invalid. The majority (70%)

of the fractures were permanent teeth, and the predominance of Class II fractures was noted. Primary teeth, however, exhibited a much higher incidence of root fracture. It has been proposed that supporting structures surrounding permanent teeth are more firm and are, therefore, less likely to allow displacement of anterior teeth due to a blow. As a result, permanent teeth are more likely to fracture than to become loosened or displaced. Primary teeth, on the other hand, are felt to be more prone to displacement injuries such as luxations, intrusions, and avulsions. This hypothesis is somewhat supported by the present investigation. Primary teeth were involved in the majority of luxation, intrusion, and avulsion injuries. However, a majority of the fractured teeth recorded were also primary teeth.

Displacement injuries accounted for a large number of the total traumatic injuries recorded. Subluxation injuries were the most common (40%); intrusive and avulsion injuries occurred at a much lower frequency (15%).

Prevention of traumatic injuries is virtually impossible in an active child population. There are, however, certain preventive measures which can be undertaken to reduce the likelihood of serious injury to the teeth and supporting structures; interceptive orthodontics can be instituted for those patients with protruding maxillary incisors to reduce the chance of injury, and athletic mouthguards can be used for sporting activities.

Use of a standardized trauma form insures at least minimal recording of diagnostic data, and allows easy access to targeted patient populations for long-term

follow-up. This should lend insight to treatment modalities and improve prognoses for various oral injuries.

## Conclusion

The current study examined the causes and types of traumatic oral injuries in a pediatric population. An attempt was made to gather information in a prospective manner and encompass a diverse population with regard to age. The incidence of various types of oral trauma has been presented.

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### Quotable quote: hazardous hot tubs

Microorganisms lurking in whirlpool baths, hot tubs, and saunas are being blamed for several cases of genital herpes and urinary tract infections in the United States. As a result, health officials are urging greater caution in using spas and closer adherence to federal hygiene standards.

Following reports of nonsexual transmission of genital herpes in some Washington, D.C. health spas, a National Institutes of Health team revealed in the *Journal of the American Medical Association* that the herpes virus can survive up to 4.5 hours on warm, wet, plastic surfaces. But the virus is destroyed on surfaces that have been disinfected properly and in water containing high levels of chlorine and bromine.

Hot tub waters contaminated with elevated levels of the bacterium *Pseudomonas aeruginosa* also pose some danger. But if the water is treated properly, no ill effects should be felt. "People should not be alarmed," says Colorado physician Paul Salmen, who has treated several bath-borne infections. "But they should know that hot tubs require careful, fastidious daily attention."

Hazardous hot tubs. Science Digest, May, 1984.