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Factors affecting coronal fracture of anterior teeth in North Jordanian children

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Abstract – The aims of this study were to investigate the incidence of coronal fracture of the anterior teeth in North Jordanian schoolchildren and to study the main predisposing factors and the factors that may affect the severity of this fracture. A study group (958) comprising schoolchildren aged 13–15 years was chosen by a simple random method from five geographical areas in Irbid Governate, Jordan. All children completed a questionnaire related to history of trauma to their anterior teeth before they had a clinical examination for lip competence, lip line and amount of fracture. Overjet was recorded from a study cast made for each student. Statistical analysis was performed using chi-square test. The results showed a prevalence of 11% of coronal fracture with female-male ratio of 1:1. An increase in the overjet more than 3 mm doubled the incidence of coronal fracture while overjet more than 6 mm increased the incidence fourfold. There was higher incidence of coronal fracture associated with lip incompetence and low lip line ($P < 0.01$). The severity of fracture increased in children with a larger overjet ($P < 0.001$). It was concluded that overjet, lip competence and lip line were important predisposing factors to coronal fracture of the anterior teeth while the severity of the fracture was mainly determined by overjet.

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Key words: coronal fracture; North Jordanians; overjet; lip line; lip competence

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Prevalence of trauma to anterior teeth in schoolchildren has been found to vary from 20–25% (1, 2). In Jordan, prevalence of trauma to anterior teeth has been reported (3, 4) without investigating the predisposing factors to such trauma.

Coronal fracture of anterior teeth has been attributed to several factors such as short upper lip or lip incompetence (5, 6) and proclination of upper anterior teeth (7–9). An increase in overjet more than 6 mm was documented to increase the risk of trauma to maxillary incisor teeth (10–12). Upper anterior teeth relationship to the E-line was suggested to be important factor in the incidence of crown fracture (13). Mouth breathing was also listed as one of the predisposing factors to trauma (7, 14).

Trauma to anterior teeth may result in a variety of dental injuries ranging from enamel crack to complete avulsion of the tooth. Although increased overjet and inadequate lip coverage may seem to influence severity of trauma, no studies examined the association of these risk factors. The aims of this study were to (i) investigate the prevalence of coronal fracture as a result of trauma to the anterior teeth in North Jordanian schoolchildren, (ii) define the main predisposing factors to coronal fracture and (iii) assess the influence of increased overjet and lip coverage on the severity of such a fracture.

Materials and methods

A total of 958 (350 males, 604 female) students aged 13–15 years in 10 representative public schools in Irbid (city in northern Jordan with a population of 800 000) were examined. Age and sex distribution are shown in Table 1. The subjects were selected from a list of schools, which was obtained from the Directorate of Education in Irbid Governate. These schools were categorized

Table 1. Age and sex distribution

Sex (*n*)	Age (years; Mean ± SD)
Females (616)	13.70 ± 0.46
Males (386)	13.45 ± 0.50

Table 2. Incisor trauma criteria (Modified NHANES III)

0 No evidence of fracture
1 Craze line
2 Enamel fracture
3 Enamel and dentine fracture
4 Pulpal involvement
5 Treated enamel and dentine fracture
6 Pulp treatment
7 Tooth avulsion

NHANES III, Third National Health and Nutrition Examination Survey.

into five sections according to geographic location. These were central part (10 schools), eastern part (12 schools), western part (12 schools), northern part (12 schools) and southern part (12 schools). Two schools containing 13–15-year-old children were selected randomly from each geographic area. Approval was obtained from individual head of schools and a consent letter was sent to students' parents or guardians.

All schoolchildren completed a questionnaire related to history of trauma to anterior teeth before they had a clinical examination for lip competence, lip line and degree of fracture under natural lighting by the first author. Alginate impressions and wax bite were taken for each student in the school premises. The impressions were poured in the same day by an orthodontic technician. Students who had orthodontic treatment or were currently wearing an orthodontic appliance were excluded from the study. Overjet was measured on the models with a flat ruler to the nearest 0.5 mm. The degree of fracture was recorded according to a modified incisor trauma criteria from the Third National Health and Nutrition Examination Survey (NHANES III) (15) (Table 2).

Twenty five of the children and study casts were re-examined 1 month after their initial examination to test the intra-examiner reliability. Kappa values for lip line, lip competence and severity of fracture were above 0.80, which indicate substantial agreement. The method error for the overjet was calculated as recommended by Dahlberg (16) and Houston (17). Dahlberg error was 0.3 mm and Houston's coefficient of reliability was 0.94.

Statistical analysis

Chi-square test was applied to determine the association between the test variables and both the susceptibility and severity of coronal fracture.

Results

The prevalence of trauma for anterior teeth in the North Jordanian schoolchildren was 11% (49% females and 51% males). The incidence of coronal fracture has doubled when the overjet increased more than 3 mm and increased by fourfolds when the overjet was more than 6 mm ($P < 0.001$). The distribution of overjet and the incidence of trauma are shown in Table 3. Sixty nine percent of children with traumatized anterior teeth had incompetent lips. The incidence of coronal fracture was 14 and 8% in subjects with incompetent and competent lips respectively. The difference was statistically significant ($P < 0.01$). Eighteen percent of the students with low lip line had a history of trauma to maxillary central incisors compared with 11% with normal lip line and 2% with high lip line ($P < 0.01$).

Results concerning severity of fracture showed that 20% of the traumatized subjects had no sign of fracture, 15% had enamel crack, 28% had enamel fracture only, 17% had enamel and dentine fracture, 8% had pulp involvement and 2% had tooth avulsion. Of the traumatized subjects 16% had treated teeth with or without pulp restoration. The results also showed that the severity of coronal fracture increased significantly with the increase in overjet ($P < 0.01$). The distribution of overjet and severity of coronal fracture is shown in Table 4.

Table 3. Distribution of traumatized subjects in relation to the size of overjet

Overjet	Total no. of subjects	No. of subjects with trauma	Percentage
Less than 3 mm	663	55	8
Between 3 and 6 mm	225	32	14
More than 6 mm	70	22	31

Table 4. Severity of fracture in relation to overjet

	Overjet			
Fracture	Less than 3 mm	Between 3 and 6 mm	More than 6 mm	Total
0	18 (82%)	1 (4.5%)	3 (13.5%)	22 (20%)
1	11 (69%)	4 (25%)	1 (6%)	16 (15%)
2	15 (50%)	11 (37%)	4 (13%)	30 (28%)
3	4 (21%)	8 (42%)	7 (37%)	19 (17%)
4	1 (11%)	6 (67%)	2 (22%)	9 (8%)
5	4 (44%)	1 (11%)	4 (44%)	9 (8%)
6	1 (50%)	0	1 (50%)	2 (2%)
7	1 (50%)	1 (50%)	0	2 (2%)

$\chi^2 = 33.2$, $P < 0.01$.

Discussion

The incidence of trauma in this study was similar to that reported for Nigerians (6) and Syrians (18) but a little higher than that for Iraqi and Sudanese (11). In the latter study, the incidence of trauma to anterior teeth was 7.7 and 5.1% in Iraqi and Sudanese children respectively. A higher incidence of anterior teeth trauma was reported in European countries ranging from 25 to 35% (5, 19, 20).

Several studies reported a higher prevalence of trauma in males than females (2, 4, 6). In this study, there were no gender differences. This result was in agreement with Burden (21) who suggested an increase in participation by girls in sports and other activities leading to more dental injuries.

The results from this study showed that lip competence, overjet and lip line were important predisposing factors in the incidence of trauma. The severity of coronal fracture, however, was mainly influenced by the overjet, the greater the overjet the more severe the fracture.

Although the severity of fracture was mainly controlled by the amount of overjet, some other factors may have an important role. These factors may include the severity and direction of the trauma and the protrusion of upper incisor teeth in relation to the E-line. In a study by Hardwick and Newman (13) it was suggested that the protrusion of maxillary incisor teeth to the line connecting the tip of the nose to the tip of the chin is related to the incidence of anterior teeth trauma. The relationship of upper anterior teeth to the E-line was described as highly reliable indicator of the vulnerability of incisor teeth to trauma as it takes into account the prominence of incisor teeth in relation to the prominence of nose and chin (10). These factors might be an explanation for the incidence of tooth avulsion in some of the cases in our study despite the relatively small overjet while in some other children there were no signs of fracture although they exhibited a large overjet.

Conclusion

1 Incidence of trauma to anterior teeth in North Jordanians 13–15-years old schoolchildren was 11%.

2 Overjet, lip incompetence and lip line were important predisposing factors to crown fracture of anterior teeth.

3 The severity of coronal fracture was mainly controlled by overjet.

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