

Predisposing Factors And Prevalence Of Fractured Anterior Teeth Among 12 And 16 Years Old School Malaysian Children

VK Gopinath * / K T Ling ** / KN Haziani *** / NM Ismail ****

OBJECTIVE: This study reports on the predisposing factors and prevalence of fractured anterior teeth among 12 and 16 years-old school children in Kubang Kerian, Kelantan, West Malaysia. **STUDY DESIGN:** A cross-sectional study was performed, involving 488 school children aged 12 and 16 years old and two calibrated dentists on the use of the World Health Organization (WHO) modification of Andreasen's 1999 classification. An oral examination was performed and all the necessary information was collected using a specified data collection sheet. The data was analyzed using the SPSS version 12. **RESULTS:** The response rate was 98.8%. The prevalence of fractured anterior teeth was 11.2% at the age of 12 and 13.4% at the age of 16. Boys experienced more fractures than girls ($p < 0.05$) among 12 year-olds but there was no gender predilection among 16 year olds. Most children could not remember the cause of fracture ($> 53.6\%$). Over 80% of dental injuries were of minor type (enamel fracture not involving the dentin). The maxillary central incisor was the most affected ($> 60\%$) tooth. Children at the age of 12 years with over jet greater than 3 mm, incompetent and short lip were predisposed to dental injuries ($p < 0.05$). There was no association between molar relationship and fractures ($p > 0.05$) in both age groups. **CONCLUSION:** The present study assessed the prevalence of dental injuries in 12 and 16 year old children and determined the risk factors that predispose to dental injuries. The possible causes and consequences of such tooth fractures must be highlighted to ensure esthetics and tooth longevity.

Keywords: Traumatic dental injury, fractured tooth, prevalence
J Clin Pediatr Dent 33(1): 39–42, 2008

INTRODUCTION

The World Health Organization (WHO) has chosen the 12 and 16 years old age group as one of the sentinel groups for monitoring the oral health of the population in Malaysia.¹ The importance of anterior permanent teeth in esthetics and function cannot be over emphasized. The anterior permanent teeth have a significant effect on the individual's facial profile. Dental trauma that results in frac-

tured, displaced or lost teeth can have significant negative functional, esthetic and psychological effects on children.²

Dental trauma in 6 and 12 year old children as studied by Zaragoza *et.al* showed a 46.2% enamel fracture with the most common fractured site being the mesio-incisal angle (40.6%). It was observed that 24% of these subjects with overjet $> 3\text{mm}$ were susceptible to develop fractured teeth.³ Boys (10.8%) were more prone to trauma of anterior teeth when compared to girls (8.9%) with more fractures to the maxillary central incisors.^{1,4} There was an increased prevalence of trauma associated with increase of age.^{5,6} The most common injuries to permanent teeth occur as a result of falls followed by other causes such as traffic accidents, violence and sports.⁷ Traumatized primary anterior teeth may result in any of the several complications on the developing permanent succedaneous teeth such as enamel hypoplasia, hypocalcification, crown/root dilacerations, disruptions in eruption, gingival retraction or abnormal pocketing. Early detection of fractured teeth could help to assure timely intervention, minimizing complications for the developing succedaneous teeth.⁸

The prevalence of traumatized permanent anterior teeth in 16 year-old school children in Malaysia was 4.1%.⁹ However, there are only a few studies performed in Malaysia

* VK Gopinath MDS, PhD Lecturer, College of Dentistry, University of Sharjah, Sharjah, United Arab Emirates

** K T Ling Year V Dental Students, School of Dental Sciences, Health Campus, Universiti Sains Malaysia.

*** KN Haziani Year V Dental Students, School of Dental Sciences, Health Campus, Universiti Sains Malaysia.

**** NM Ismail, DDPHRC, MSc Senior Lecturer, School of Dental Sciences, Health Campus, Universiti Sains Malaysia.

Send all correspondence to: V.K. Gopinath, College of Dentistry, University of Sharjah, P.O. Box 27272, Sharjah, United Arab Emirates

Office: (+971 6) 5057308

Fax: (+971 6) 5585641

E mails: vgopinath@sharjah.ac.ae; gopinathvk@yahoo.com

about traumatized permanent anterior teeth among school children compared to other parts of the world. This study aimed to determine the prevalence and predisposing factors of traumatic injuries to permanent anterior teeth among 12 and 16 years old school children in Kubang Kerian, Kota Bharu, West Malaysia.

MATERIALS AND METHOD

A cross sectional study of fractured anterior teeth involving 488 school children aged 12 years (n=250) and 16 years (n=238) was performed. The reference population included 12 and 16 years old school children in Kota Bharu while the source population included children from the nearby "Sekolah Menengah Kebangsaan Kubang Kerian 1" (SMKKK 1) secondary school. The sample size was determined from estimates found in various literature sources. A systematic random sampling method was used for sample selection. The following inclusion and exclusion criteria were considered. Subjects with any congenitally missing upper or lower anterior teeth and mentally handicapped children were excluded. Healthy boys and girls aged 12 and 16 years old were included. The Ministry of Education of Malaysia and school authorities approved this project. Parents were informed and a written consent was obtained prior to the study. Calibrated researchers collected the data in standardized data collection sheets. The children were examined with disposable mouth mirrors and probes while seated on a portable chair with good operating light. Information concerning sex, age, cause of trauma, number of injured teeth, type of fracture, site of injury, molar relationship, incisor relationship with measurement of overjet, complication and type of treatment done on the traumatized tooth were recorded. Vitality of the fractured tooth was determined with an electric pulp tester using stan-

dard protocols. The fractured teeth were classified based on the World Health Organization (WHO) modification of Andreasen's 1999 classification as below.

1. Enamel infraction: An incomplete fracture (crack) of the enamel without loss of tooth substance.
2. Simple enamel fracture (uncomplicated crown fracture): A fracture with loss of tooth substance confined to the enamel.
3. Enamel-dentin fracture (uncomplicated crown fracture): A fracture with loss of tooth substance confined to enamel and dentin, but not involving the pulp
4. Complicated crown fracture: A fracture involving enamel and dentin, and exposing the pulp.
5. Avulsion (exarticulation): Complete displacement of the tooth out of its socket.

The data analysis included descriptive statistics. Association between the occurrence of fractured anterior teeth with sex, age, incisal overjet, lip coverage, incisor and molar relationship were performed using the chi-square and Fisher's exact test. The data was analyzed using the SPSS version 12 and the level of significance was set at $p < 0.05$.

RESULTS

A total of 488 children aged 12 years (113 boys, 137 girls) and 16 years (99 boys, 139 girls) from SMKKK 1 were examined. About 43.4% were boys and 56.6% were girls. The response rate was 98.8%. Our findings showed that the prevalence of fractured anterior teeth among 12 year-olds in SMKKK 1 was 11.2% and 13.4% among 16 year-olds. The difference in prevalence between boys and girls was statistically significant among 12 years-old children ($p=0.011$) only. Analyses of the relationship between fractured anterior teeth to its predisposing factors showed that only children at the age of 12 years old with incisal over jet greater than

Table 1. Distribution of gender and predisposing factors of fractured permanent anterior teeth among 12 year-old school children in Kubang Kerian.

Variables	Total	Fractured tooth N (%)	X ² statistic ^a (df)	P value
Gender				
Male	113	19 (16.8)	6.53 (1)	0.011
Female	137	9 (6.6)		
Incisor relationship				
Class II	19	4 (21.1)	2.00 (1)	0.244 ^b
Other class	231	24 (10.4)		
Molar relationship				
Class II	25	1 (10.0)	0.02 (1)	1.000 ^b
Other class	225	27 (11.2)		
Short lip/ incompetent lip				
Yes	6	6 (21.4)	48.74 (1)	0.000 ^b
No	244	22 (78.6)		
Overjet				
< 3mm	165	12 (7.4)	7.52 (1)	0.006
3mm or more	85	16 (18.8)		

^a Chi-Square test for independence

^b Fisher's Exact test

Table 2. Distribution of gender and predisposing factors of fractured permanent anterior teeth among 16 year-old school children in Kubang Kerian.

Variables	Total	Fractured tooth Frequency (%)	X ² statistic ^a (df)	P value
Gender				
Male	99	14 (14.1)	0.07 (1)	0.791
Female	139	18 (12.9)		
Incisor relationship				
Class II	33	3 (9.4)	0.62 (1)	0.586b
Other class	205	29 (90.6)		
Molar relationship				
Class II	12	2 (6.3)	0.11 (1)	0.667b
Other class	226	30 (93.7)		
Short lip/ incompetent lip				
Yes	101	5 (15.6)	10.88 (1)	0.001
No	137	27 (84.4)		
Overjet				
3mm or less	206	25 (78.1)	2.26 (1)	0.161b
> 3mm	32	7 (21.9)		

^a Chi-Square test for independence

^b Fisher's Exact test

3mm, incompetent and short lips were predisposed to fractures ($p < 0.05$). There was no association between molar and incisor relationship with traumatic dental injuries ($p > 0.05$) in both age groups (Table 1 and 2).

Most children could not remember the cause of fracture, followed by falls, sports, road traffic accidents and epileptic attacks (Table 1 and 2). Simple enamel fractures were the most common type of injury (85.7% for 12 year-olds and 81.3% for 16 year-olds). The maxillary central incisor was the most traumatized tooth (65.6% for 12 year-olds and 60% for 16 year-olds). The most common fractured site was the disto-incisal edge (43.2%) at the age of 12 years compared to mesio-incisal edge (37.5%) at the age of 16 years.

Children with traumatized anterior teeth did not undergo dental treatment. Most children encountered no dental complications except for two children aged 12 years old with discoloration on the fractured tooth. However, among the 16 year-olds, eight fractured teeth were found to be non-vital and three of these were tender to percussion.

DISCUSSION

This study showed that the prevalence of fractured anterior teeth was 11.2% among children aged 12 years and 13.4% among children aged 16 years. This percentage is high when compared to a previous study conducted elsewhere in Malaysia showing a prevalence of traumatized permanent anterior teeth among 16 year-old school children of 4.1%.⁹ In Amman, Jordan, the prevalence of dental injuries reached 15% at the age of 11–12 years.⁶ In Iraq it reached 19.5% and 16.1% for boys and girls respectively at the age of 12 years. The prevalence of dental injuries among Sudanese boys and girls were 16.5% and 3.6% respectively at the age of 12 years.¹⁰ These two studies showed a higher prevalence of dental injuries than our current findings. The prevalence of fractured anterior teeth was found to be higher among 16 year-olds when compared to 12 year-olds in the present study, this could be the result of more children being involved in vigorous sports as they progress through their teen years. This has been reported in previous studies showing that at each year 1.5% to 3.5% of children participating in contact sports sustain dental injuries.¹¹

The difference in prevalence between boys and girls was statistically significant among 12 year-olds with a ratio of 2:1 and this finding was similar with another study from Thailand.⁷ This could be explained by the common fact that boys are known to be more active and tend to be involved in more vigorous activities compared to girls. However, there was no significant difference by gender among 16 year-olds. This finding was reported by other authors in Damascus, Syria.¹²

As reported in a previous study,¹³ most injuries involved only one upper central incisor. In this study the most frequently injured tooth was the maxillary central incisor and the least traumatized was the mandibular canine. In most of the cases, crown fractures involved the enamel layer only. The disto-incisal edge was the most common fractured site for 12 year-olds while the mesio-incisal edge fracture was

the commonest among 16 year-olds. These results correlate with the findings of a previous study.⁴ The present work showed that short and incompetent lips and an increased overjet of 3 mm or more were significant predisposing factors to fracture of the permanent anterior teeth for 12 year-old school children in Kubang Kerian. These findings correlate with the findings of a previous study in Spain.³ There is a tendency for 16 year-old children with short and incompetent lips to have experienced fractured anterior teeth. However, there was no significant association between an increased overjet, and incisor and molar relationship with fractured anterior teeth.

The reasons for the untreated fractured teeth in this study may be attributed to the fact that, among the children who sustained fractured permanent anterior teeth, most did not notice the lesion probably because of the site and size of fracture. The present study showed that among 12 year-olds, there was only one case of enamel-dentin fracture involving the entire incisal edge without pulp exposure. However, the tooth was still vital and non-tender to percussion. Two teeth were untreated avulsion cases and upon questioning, it was noted that these two children were less concerned about their oral health status. There were no dental complications reported except for a few subjects who showed discoloration on the affected teeth. Meanwhile, pulp vitality test results showed that most of the affected teeth were still vital. Among 16 year-olds, it was observed that eight fractured teeth were non-vital and three of these were tender to percussion.

Secondary school children obviously need more information regarding the importance of teeth. This will help them seek dental care when faced with dental problems to prevent dental complications in the future. The possible causes and consequences of such tooth fractures must be highlighted to ensure children develop awareness regarding the health of the fractured tooth and ways to prevent such dental injuries must be emphasized to children at risk.

CONCLUSION

- Prevalence of fractured anterior teeth in 16-year-old children was higher than in 12 year olds.
- Anterior teeth fractures were more common in boys than in girls in the 12 years age group.
- Children with overjet greater than 3 mm were predisposed to develop fractures of the anterior teeth.
- Complications such as non-vital teeth were noted in the 16 year-old children.

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