Prevalence of Anterior Tooth Trauma in an Orthodontic Population

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Abstract

Background: There is a possibility that an increased overjet and lip incompetence among the orthodontic population may contribute to tooth trauma, which might make them require early interceptive orthodontics as a trauma preventive measure.

Objectives: The objectives of this study were to determine the prevalence of trauma to permanent anterior teeth and assess possible predisposing factors in a Nigerian orthodontic population.

Methodology: This was a prospective, cross sectional descriptive study of patients aged 7-39 years who presented at the Orthodontic Clinic of the Lagos University Teaching Hospital Idi-Araba, Lagos Nigeria over a 5 year period. A self administered questionnaire was used to provide information which included the patients' biodata, age at time of trauma, type of trauma, teeth involved in trauma, type of malocclusion and lip pattern.

Results: A trauma prevalence of 8.1% was observed, with the maxillary central incisor being the tooth most frequently affected and accounting for 73% of all traumatised teeth. Males were significantly more affected than females, and Angle's Class I malocclusion was the most frequently observed molar relationship in affected patients (69.4%).Approximately 72% of all subjects who suffered trauma had lip incompetence, while 77.1% presented with an increased overjet. The majority of injuries seen were noted to have occurred before the age of 10 years (63.9%).

Conclusion: Increased overjet and lip incompetence were observed to be predisposing factors to anterior tooth trauma. Therefore, interceptive orthodontics may be of benefit to these patients so predisposed to reduce its occurrence.

Keywords: Prevalence, anterior tooth trauma, orthodontics.

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Introduction

Traumatic dental injury has become the most serious dental public health problem in children since a remarkable decline in the prevalence and severity of dental caries in many countries1. In Nigeria, the prevalence of anterior tooth trauma in children aged 6-16 years was reported to range from 6.5%-19.1%[2--5], while the prevalence of trauma in preschool children was 30.8% [6, 7]. Anterior teeth play a significant role in aesthetics, speech and functional activities involving the mandible, however, their morphology and location make them susceptible to trauma [8-10]. Common traumatic injuries include enamel fracture, enamel and dentine fracture, with or without pulpal involvement. Avulsions, intrusive and extrusive injuries have also been reported with teeth in the maxilla more frequently affected than the mandible[1-12].Lip incompetence, Class II malocclusion and increased overjet have been reported as possible risk factors for anterior tooth trauma by previous researchers [1, 4,7,11]. Orthodontic treatment can modify/correct some of these risk factors and reduce susceptibility to anterior tooth trauma. The paucity of data on the prevalence of anterior tooth trauma in an orthodontic population in Nigeria, justified the rationale for the study. The objectives of this study therefore were to determine the prevalence of anterior tooth trauma and possible predisposing factors in an orthodontic population in Lagos, Nigeria.

Materials and Methods

This study was a prospective, cross sectional, descriptive survey of patients aged between 7-39 years who presented at the Orthodontic Clinic of the Lagos University Teaching Hospital over a 5 year period. A total of 893 subjects (335 males and 558 females) were recruited for the study.

All the subjects who participated in the study were examined under natural lighting by trained and calibrated dentists and a self administered

questionnaire was administered to each of them. Demographic data including age, and gender were obtained. Other relevant data obtained included the age at time of trauma, type of trauma sustained, location of trauma, teeth involved in trauma, molar relationship ,overjet and lip pattern.

Trauma to anterior teeth was recorded to be present if any evidence of injury on one or more maxillary or mandibular incisors or canine was observed. The Andreasen's classification of tooth trauma was used[13].

The classification includes

- Uncomplicated Enamel fracture (enamel chipping or crack)
- Enamel and dentine fracture (uncomplicated crown fracture), without pulpal involvement
- Complicated crown fracture involving enamel, dentine with pulpal exposure
- Root fracture
- Crown-root fracture, with or without pulpal involvement
- Injuries to the periodontal tissues (luxation injuries): concussion,lateral luxation, extrusive luxation ,intrusive luxation, subluxation.
- Avulsion

The lip pattern/ coverage was classified as either competent or incompetent using Jackson's method of assessing lip competence. The overjet was measured in millimetres from the most prominent maxillary central incisors to the corresponding lower incisors. An overjet of 1-3 mm was scored as normal with a score greater than 3mm considered increased overjet, and 6mm was considered to be greatly increased.

The molar relationship was assessed using Angle's classification into Class I, Class II and Class III malocclusions[14]. In Class I molar relationship, the mesio buccal cusp of the upper first molar occludes in the buccal groove of the lower first molar and was considered normal, while a malocclusion was considered class II if the mesiobuccal cusp of upper first molar occluded half a unit mesial to the buccal groove of the lower first molar. A class III malocclusion was associated with the lower first molar occluding half a unit mesial to the mesiobuccal cusp of the upper first molar.

The statistical analysis of data was performed using Epi. info version 7.1.0.6 (2012) software. Descriptive statistics (mean values and standard deviation) of the mean age of trauma subjects and number of teeth involved in trauma were calculated taking age into consideration. The age at injury, overjet of the study population, molar relationship of the study population and the location and cause of injury and their significance were analysed using Chi square statistics.

Results

A total of 893 subjects aged 7-39years who presented to the Orthodontic Clinic of the Lagos University Teaching Hospital Idi-Araba, Lagos Nigeria were recruited for the study. Of these subjects, 72 had sustained trauma to anterior teeth, this included 37 males and 35 females with an overall prevalence of 8.1%. The males had a statistically significant higher prevalence of anterior trauma when compared to females with a prevalence of 11.0% & 6.3% respectively (P=0.012) (Table I).

Age Distribution of Study Subjects

The age range of subjects in the study population who presented with anterior tooth trauma ranged from 7 to 39 years (Table II, Figure 1). The majority of the subjects were aged 7-9 years and constituted 59.7% of all trauma subjects (p=0.01), with the males sustaining trauma at a much younger age when compared to the females (0.023). Forty percent of the female trauma subjects were in this age range while for the male trauma population, it was as approximately 78% (Table II). A lower prevalence of trauma was observed with an increase in age for both genders with an overall mean age of 10.7 years.

Pattern of Injury of the Study Population

One hundred and twenty two traumatised anterior teeth were observed in 72 orthodontic patients with anterior tooth trauma, representing approximately 1.7 teeth per accident. The number of teeth involved ranged from 1-7, with single tooth trauma found to be most predominant and

Table I: Gender Distribution of the Study Population

	Male	Female	Total	X^2	P value
	N (%)	N (%)	N (%)		
Non- trauma	298 (89.0)	523(93.7)	821(91.9)		
Trauma	37(11.0)	35(6.3)	72(8.1)	6.43	0.012
Total	335(100)	558(100)	893(100)		

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Table II: Age of Subjects at Time of Injury

Age At Injury (YEARS)	Males N (%)	Females N (%)	Total N (%)
7	17 (45.9)	8 (22.9)	25 (34.7)
8	9 (24.3)	5 (14.3)	14 (19.4)
9	3 (8.1)	1 (2.9)	4 (5.6)
10	0 (0.0)	3 (8.5)	3 (4.2)
11	1 (2.7)	2 (5.7)	3 (4.2)
12	2 (5.7)	3 (8.5)	5 (6.9)
13	1 (2.7)	3 (8.5)	4 (5.6)
14	0 (0.0)	1 (2.9)	1 (1.4)
15	1 (2.7)	1 (2.9)	2 (2.8)
16	0 (0.0)	2 (5.7)	2 (2.8)
18	2 (5.4)	1 (2.9)	3 (4.2)
19	0 (0.0)	3 (8.5)	3 (4.2)
21	1 (2.7)	0 (0.0)	1 (1.4)
26	0 (0.0)	1 (2.9)	1 (1.4)
39	0 (0.0)	1 (2.9)	1 (1.4)
TOTAL	37 (100)	35(100)	72 (100)
MEAN AGE	9.1	12.4	10.7

accounting for 56.9% of the trauma subjects (Table 3).This was followed by trauma to 2 teeth with a prevalence of 27% and 28.6% in males and females respectively. Anterior tooth trauma occurred predominantly in the maxillary arch (95.7%), with the maxillary central incisor accounting for 73% of all traumatised teeth, followed by the maxillary lateral incisors (15.7%), while the mandibular canine sustained the least trauma (2.9%). There was however; no significant difference in the number of traumatised teeth between genders (P=0.234) A left sided predilection for trauma though statistically insignificant was observed with a ratio of 1.2:1 (P=0.27).

Type of Tooth Trauma

Uncomplicated crown fracture of enamel was found to be the most common form of trauma accounting for 36.2% of all fractures (Figure 2). This was followed by enamel and dentine fracture seen in 23.6% of all trauma cases. Other types of trauma observed include concussion, subluxation, intrusive and extrusive luxation, crown root fracture, avulsion, root fraction and enamel infraction. There was however, no statistical difference in the type of trauma observed between males and females (P=0.419).

Overjet of Study Population

Overjets ranging from -3mm to 16mm were observed in the study population with a mean overjet of 6.6mm. Approximately 64% of trauma subjects had an overjet of 6mm and above with the highest frequency of trauma occurrence observed in subjects

Table III: Number of Teeth Involved In Trauma

Number of teeth Involved	Males N (%)	Females N (%)	Total N (%)	Chi sq	P value
1	23 (62.2)	18 (51.4)	41 (56.9%)		
2	10 (27)	10 (28.6)	20 (27.8%)	5.55	0.235
3	3 (8.1)	3 (8.6)	6 (8.3%)		
4	0 (0.0)	4 (11.4)	4 (5.6%)		
7	1 (2.7)	0 (0.0)	1 (1.4)		
Total	37 (100)	35 (100)	72 (100)		
Fishers exact P =0.234					

Table IV: Overjet of The Study Population

OVERJET (mm)	Male N (%)	Female N (%)	Total N (%)	χ^2	P value
-3	0 (0.0)	1 (2.9)	1 (1.4)		
-2	0 (0.0)	2 (5.7)	2 (2.8)	5.00	0.172
0	1 (2.7)	1 (2.9)	2 (2.8)		
2	5 (13.5)	0 (0.0)	5 (6.9)		
3	2 (5.4)	2 (5.7)	4 (5.6)		
4	2 (5.4)	2 (5.7)	4 (5.6)		
5	2 (5.4)	6 (17.1)	8 (11.1)		
6	3 (8.1)	4 (11.4)	7 (9.7)		
7	5 (13.5)	4 (11.4)	9 (12.5)		
8	4 (10.8)	5 (14.3)	9 (12.5)		
9	4 (10.8)	3 (8.6)	7 (9.7)		
10	1 (2.7)	2 (5.7)	3 (4.2)		
11	4 (10.8)	0 (0.0)	4 (5.6)		
12	1 (2.7)	2 (5.7)	3 (4.2)		
13	2 (5.4)	1 (2.9)	3 (4.2)		
16	1 (2.7)	0 (0.0)	1 (1.4)		
Total	37 (100)	35 (100)	72 (100)		

Fischers p=0.183

Table V: Type of Malocclusion/ Molar Relationship of Trauma Subjects

ANGLE'S CLASSIFICATION	MALES N (%)	FEMALES N (%)	TOTAL N (%)	χ^2	P value
CLASS I	27 (73%)	23 (65.7%)	50 (69.4%)		
CLASS II DIV I	10 (27%)	10 (28.6%)	20 (27.8%)	2.26	0.519
CLASS II DIV II	0 (0%)	1(2.9%)	1 (1.5%)		
CLASS III	0 (0%)	1(2.9%)	1(1.5%)		
TOTAL	37 (100%)	35 (100%)	72(100%)		

Fischers exact P =0.600

Table VI: Cause of Injury

Cause of injury	Males N (%)	Females N (%)	Total N (%)	χ^2	P value
Collision	1 (2.7)	1 (2.9)	2 (2.8)	0.173	0.917
Fall	28 (75.7)	25 (71.4)	53 (73.6)		
Impact	8 (21.6)	9 (25.7)	17 (23.6)		
Total	37 (100)	35 (100)	72 (100)		
Fishers p = 0.890					

Table VII: Gender distribution of Injury Location

Where Injury occurred	Males N (%)	Female N (%)	Total N (%)	χ^2	P value
Home	17 (45.9)	22 (62.9)	39 (54.1)	2.89	0.235
Outdoors	11 (29.7)	5 (14.3)	16 (22.2)		
School	9 (24.3)	8 (22.9)	17 (23.8)		
Total	37 (100)	35 (100)	72 (100)		

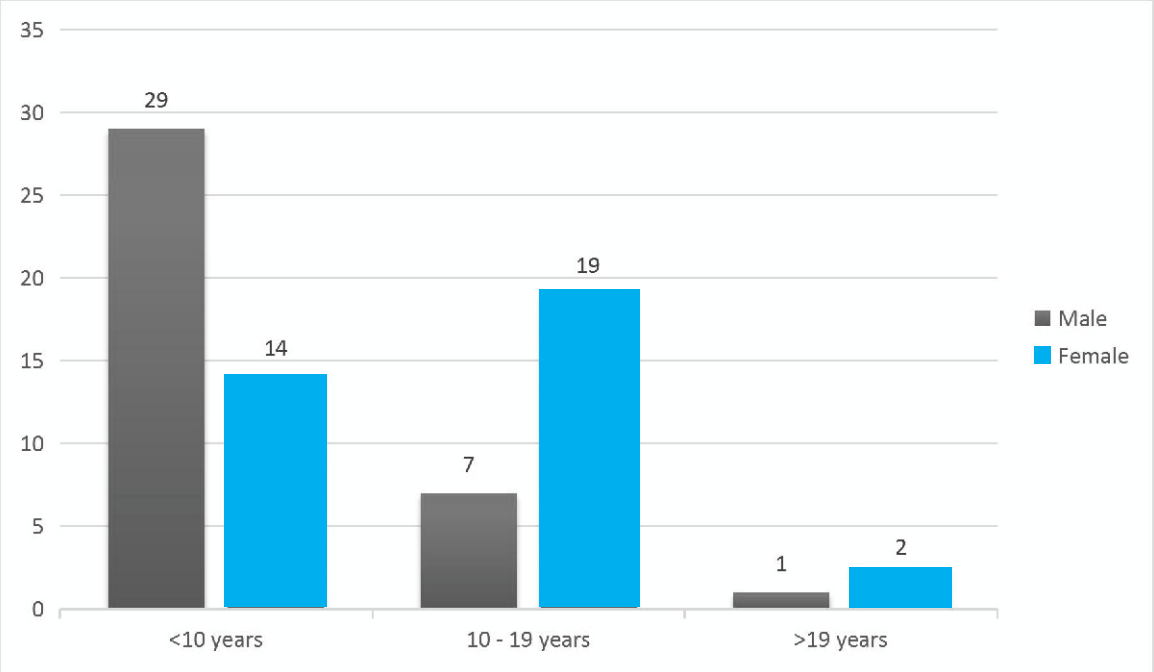

Figure 1: Gender Distribution of Age at Injury

with an overjet of 8mm and 9mm (25%) (Table IV). The least trauma was observed in patients with overjets of -3mm(1.4%).The difference in overjet between the males and females was statistically insignificant (p=0.183).Approximately 72% of subjects who presented with anterior tooth trauma had inadequate lip coverage (p=0.045).

Type of Malocclusion/ Molar Relationship

Angle's Class I molar relationship was seen in the majority of patients (69%) followed by Angle's Class II div 1 malocclusion seen in 27.8% of all trauma subjects. Subjects with class II Div 2 and class III molar relationship had the least incidence of trauma with a prevalence of 0% and 2.9% in both males and females respectively (Table V)

Location and Cause of Injury

The leading cause of injury was falls for both genders accounting for 75.7% and 71.4% of trauma in males and females respectively, followed by impact which occurred in 23.7% of trauma subjects (Table VI). Most injuries occurred at home (54.4%), followed by school (23.6%) and outdoors (22%). A higher percentage of females (62.9%) sustained injuries at home compared to males (45.9%). The location of injury however was not significantly different between the genders (p=0.234) (Table VII, Figure 3).

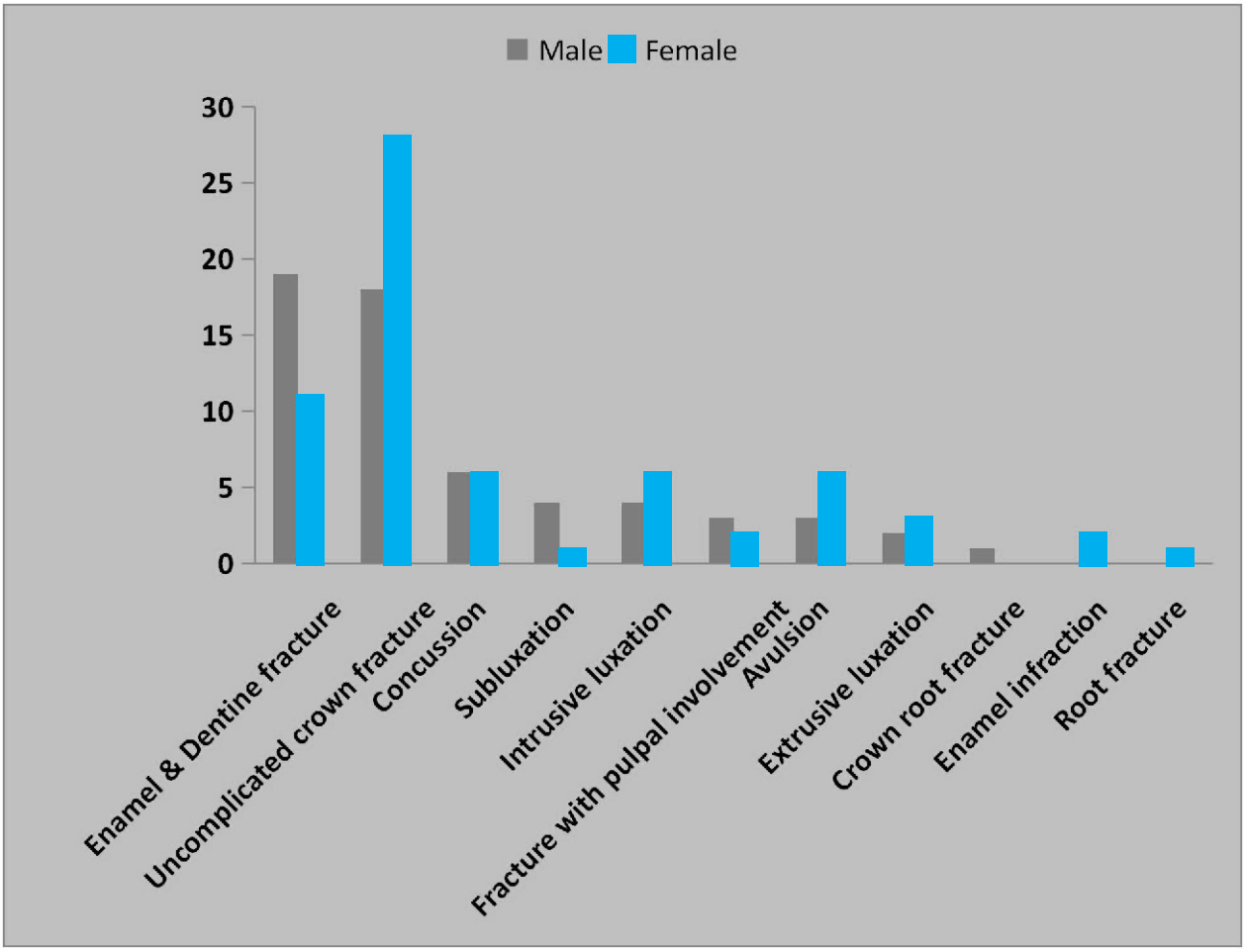

Figure 2: Types of trauma in the study population

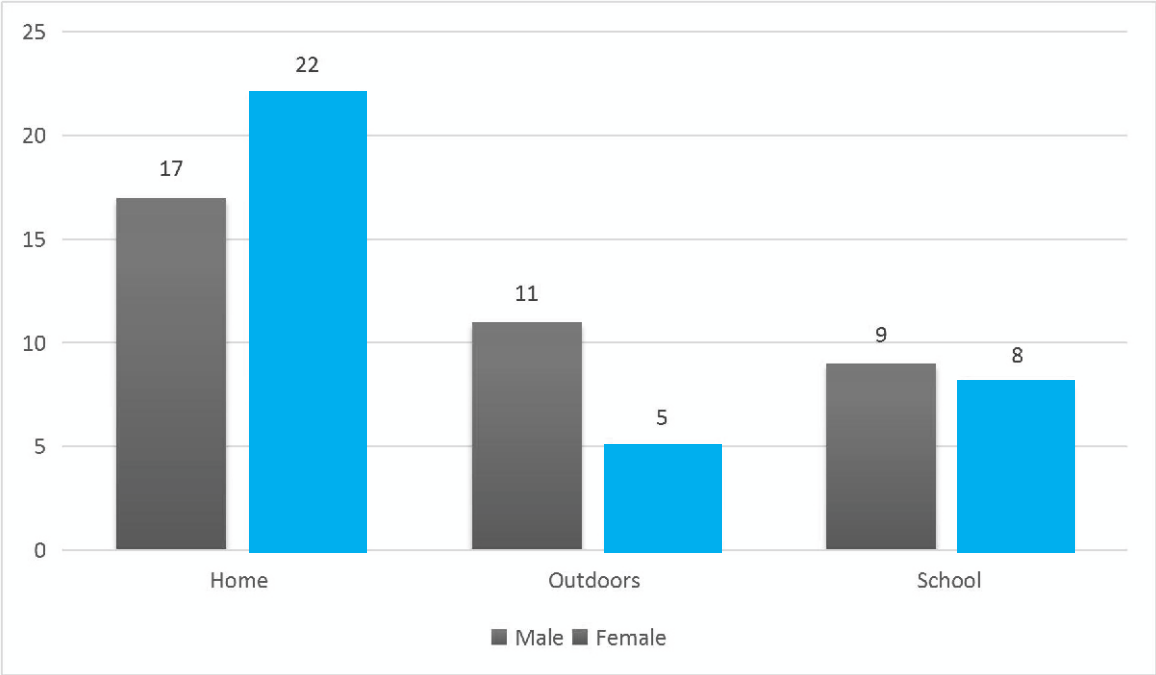

Figure 3: Gender Distribution of Injury Location

Discussion

The results of the present study showed that a significant number of orthodontic patients sustain trauma to anterior teeth before presentation. A prevalence of 8.1% was observed in this orthodontic population. This was similar to the prevalence of trauma observed in the general population in previous studies that investigated the prevalence of trauma in the Nigerian population[2-9]. A higher prevalence of trauma was observed in males in the present study; and is consistent with most previous studies [1-8, 10, 11,16-19], but contrary to the finding of Osuji9, who observed no difference in the prevalence of trauma between males and females. Most previous studies however, were epidemiological surveys and comparisons with the present study may be misleading. Our survey observed an overall peak age of 7 for dental trauma which was lower than the findings from most previous investigators who reported a peak age of between 10-15 years[18-20].

As reported in previous studies, the maxillary teeth were more frequently traumatised[1, 2-12, 16-20].Similarly, most trauma involved one tooth and the maxillary central incisor was the teeth most frequently traumatised tooth and this finding is consistent with that of previous researchers[2,3,6-9,18]. The location of the teeth with their increased prominence in the presence of an increased overjet may be responsible for their increased susceptibility to trauma in our study population. Uncomplicated enamel fracture was the most common injury recorded in this study, which is in agreement with result reported by various authors [2,12,22] but contrasts with results from other studies who reported enamel-dentine fracture, luxation, and subluxation as commonest types of injury [10,22].

Falls were the major cause of anterior tooth trauma in this study as reported by other investigators in previous studies[11, 20, 23, and 24]. This finding therefore suggests that the use of mouth guards during contact sports may not be an effective prophylactic measure in preventing tooth trauma, as collision and impact accounted for only approximately a quarter of the trauma cases. This statement is made truer from the finding that most of the injuries were sustained at home in this study.

The majority of subjects who presented with anterior tooth trauma in this study had an increased overjet. This is associated with an increased prominence of the maxillary teeth and predisposes to trauma[2, 7,9,10]. Inadequate lip coverage was also a common observation in majority of the subjects with tooth trauma in this study. This is in keeping with some previous researchers[7,10]. A lack of protective covering of the teeth by the lips may be a reason for the increased incidence of trauma in subjects with incompetent lips.

Based on the findings of this study, an increased overjet of greater than 6mm and inadequate lip coverage are potential risk factors for the occurrence of anterior tooth trauma. It may therefore be beneficial to carry out measures to reduce the possibility of its occurrence.

Recommended trauma Prevention options include[7, 25]:

- Adequate counseling of the patient and guardian on the risk of anterior tooth trauma, and take adequate care during contact sports and at home to reduce the chances of occurrence
- The use of a protective mouth guard during contact sports. This could reduce the incidence of trauma as a result of impact.
- Important supervision of children at all times especially on furniture, stairs, at the play ground and at athletic events or practices.
- Interceptive orthodontics: It may be beneficial to institute early phase orthodontic treatment in patients with an increased overjet as a form of trauma prophylaxis. Almost 2/3 of cases of anterior tooth trauma among patients in this study occurred in patients with an overjet greater than 6mm.

Based on the findings of this study, the treatment should be performed before age 10 years, with an aim of reducing the overjet, as almost 60% of the sample group with trauma sustained the injury before 10 years of age. This would reduce possibility of early tooth loss from trauma, development of complications from damage to the teeth with consequent extensive dental treatment e.g. endodontic treatment, and reduce the complications associated with orthodontic movement of traumatised teeth e.g. root resorption and ankylosis.

Conclusion

Anterior tooth trauma was observed in 8.1% of the orthodontic population studied. Male gender, lip incompetence in combination with an increased overjet greatly increased the predisposition to tooth trauma. It may therefore be beneficial to institute early phase treatment in patients with an increased overjet as a form of trauma prophylaxis. This would reduce the likelihood of trauma to these teeth as well as the possibility of development of complications associated with orthodontic movement of

traumatised teeth.

Contributors

DOO, UOD, AIC,IM were responsible for data collection and writeup.

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Self

Conflict of Interest

Nil

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