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Characterisation of the occlusal traits of adults with dental trauma in a tertiary hospital in Nigeria

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Abstract
Objective: To characterise the occlusal traits of adult patients presenting with dental trauma as well as relate the number of teeth affected by the trauma and severity of the injury with the occlusal traits.
Method: This was a questionnaire-based descriptive cross-sectional study carried out among adult patients who attended UBTH Dental centre between August 2014 and May 2017. Teeth were checked for any evidence of trauma and the number of teeth affected was recorded. The posterior occlusal trait was assessed using the Angle's classification while the anterior occlusal traits involved assessment of the horizontal and vertical occlusal relationships. Data was analysed using SPSS version 21.0. The analysis done were frequencies, cross-tabulations, one-way ANOVA and linear regression with statistical significance set at P=0.05
Results: A total of 250 patients were recruited for the study. Majority (88.8%) of the participants had Angle's Class I occlusion with over jet and open bite observed in 10.8% and 8.8% of the participants respectively There was statistically significant difference in the mean number of traumatised teeth with the different molar relationships (p=0.032), different horizontal occlusal relationships (p=0.049) and different vertical occlusal relationships (p=0.006), with the mean number of traumatised teeth among participants with Angle's class III, over jet as well as open and deep bite significantly higher. There was no statistically significant relationship between the severity of injury and the various occlusal traits assessed.
Conclusion: Occlusal traits are associated with the number of traumatised teeth in adult patients but not with the severity of injury occasioned by the traumatic incident.

Keywords: occlusal traits, dental trauma, severity of injury

Introduction

Dental trauma is considered a dental public health issue due to its high prevalence and impact on oral health related quality of life. Its occurrence is associated with psychological, social, therapeutic and financial consequences that have a great burden on individuals and the society [1, 2]. Although, dental trauma is reported to be more prevalent in children and the adolescents, Shulman reported that in adulthood, the incidence of trauma increases with age peaking between ages 21-30 years [3].

Dental trauma has been linked to a number of predisposing/risk factors. Predisposing factors suggested include socio economic class, insufficient lip closure and protrusion of upper incisors [4, 9] Some other occlusal traits which deviate from the ideal occlusion characteristics have been reported to predispose to traumatic dental injuries [10].

Many researchers have reported the association between dental trauma and malocclusion but quite a number appeared to be limited to anterior occlusal traits [3, 11, 13]. Furthermore, there is paucity of studies characterising the occlusal traits of adult patients with dental trauma. It is therefore worthy to consider the occlusal traits of adults who have dental trauma and see if there are any associations between the occlusal traits and characteristics of the dental trauma.

It is on this premise that this study was designed to characterise the occlusal traits of adult patients with dental trauma as well as relate the severity of the trauma and the number of teeth affected by the trauma with the occlusal traits of the patients.

Methodology

This was a descriptive cross-sectional study carried out among adult patients who attended the University of Benin Teaching Hospital (UBTH) Dental centre. The study population was all adult patients with traumatized anterior teeth with or without maxillofacial trauma. Ethical approval was obtained from the UBTH ethical review committee.

Study duration was August 2014 to July 2017. A convenience consecutive sampling design was employed. Data was obtained by means of a pre-tested questionnaire. Demographic characteristics (age, sex, occupation, level of education, marital status, religion and tribe) were documented. The other aspects of the questionnaire were history taking and clinical examination. A thorough history from the patient and the traumatic incident was obtained. The pre-injury data included biographic and demographic data, past medical history, time, location and mechanism of accident, occlusion and loss of consciousness.

The initial examination was systematic, methodical, and comprehensive. All traumatized teeth were assessed for enamel, dentine, and pulpal involvement. Superficial crazing or infractions may be identified with a direct light source, trans illuminating perpendicular to the long axis of the tooth from the incisal edge. Teeth were checked for any displacements,

intrusions, or luxations and noted. Also, the number of teeth affected (single vs. multiple) per participant was also recorded. For the purpose of analysis, the severity of the trauma was categorised into three in the order of severity from the most severe as follows: avulsion and crown-root fractures (III, traumatised teeth with pulpal involvement and teeth with combination injuries (II) and traumatised teeth without pulpal involvement (I). In cases where there were multiple traumatised teeth, the most severe injury was used for the categorisation.

The posterior occlusal trait was assessed with the Angle's classification [14] as follows;

Class I – The mesiobuccal cusp of the permanent maxillary first molar occludes in the buccal groove of the permanent mandibular first molar.

Class II – The mesiobuccal cusp of the permanent maxillary first molar occludes mesial to the buccal groove of the permanent mandibular first molar.

Division 1 – with proclination of the maxillary incisor teeth

Division 2 – with retroclination of the maxillary incisor teeth

Class III – The mesiobuccal cusp of the permanent maxillary first molar occludes distal to the buccal groove of the permanent mandibular first molar.

The anterior occlusal traits involved assessment of the horizontal (overjet) and vertical (overbite) occlusal relationships which are the relationships of the upper and lower incisors in the horizontal and vertical planes respectively. The vertical occlusal relationship was classified into normal overbite (33-50%), deep bite (>50%) and reduced/open bite (<10% or with no overlap or space between the upper and lower incisors vertically) while the horizontal occlusal relationship was classified into normal (1-3mm with the maxillary incisors in front of the mandibular incisors), increased (> 3mm) and reverse overjet (mandibular incisor occluding ahead of the maxillary incisors).

Data collected was analysed using the Statistical Package for Social Science (SPSS) version 21.0. The data was subjected to descriptive analysis in the form of frequencies, percentages and cross-tabulations. The difference in mean was determined by one-way ANOVA and the post hoc LSD was applied. Linear regression was used to determine any possible occlusal predictor of number of traumatised teeth. Statistical significance was set at P=0.05

The results were presented in form of frequencies, percentages, pie charts, graphs, tables and cross tabulations.

Results

A total of 250 patients were recruited for the study. The age of the participants ranged from 16years to 71 years with a mean age of 30.59±11.20years. There was a female preponderance (Figure 1) with male to female ratio of 1:1.08.

Fall was the most prevalent (33.6%) aetiology reported among the participants. The least reported aetiology was iatrogenic dental event accounting for 0.8% (Table 1). Majority (88.8%) of the participants had Angle's Class I occlusion with over jet and open bite observed in 10.8% and 8.8% of the participants respectively (Table 2).

The participants presented with a range of 1 to 9 traumatised anterior teeth with the mean number of traumatised teeth being 1.88±1-28. About half (49.6%) of the participants had only a single tooth traumatised with 82.8% of the traumatised anterior teeth being maxillary anterior teeth (Figure 2). A few (10.4%) of the participants had teeth traumatised in both arches. More than half (59.2%) presented with injuries involving the pulp while 29.6% had injuries with no pulpal involvement and 11.2% presented with avulsion injuries.

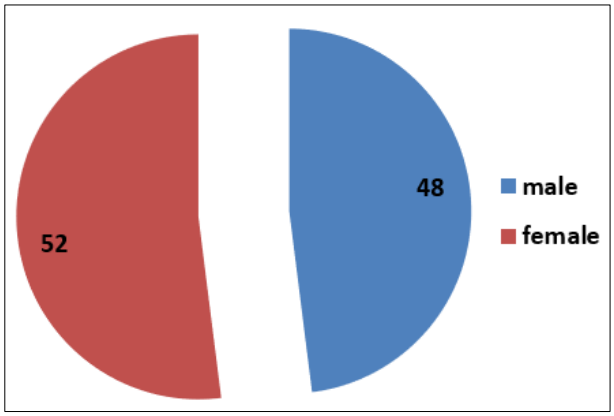

Fig 1: Gender distribution of the participants

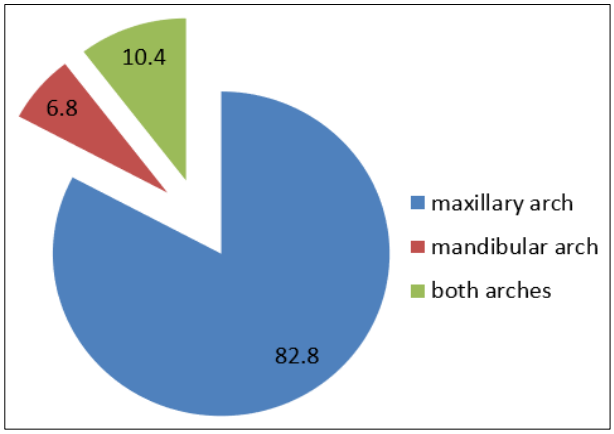

Fig 2: distribution of traumatised teeth by arch.

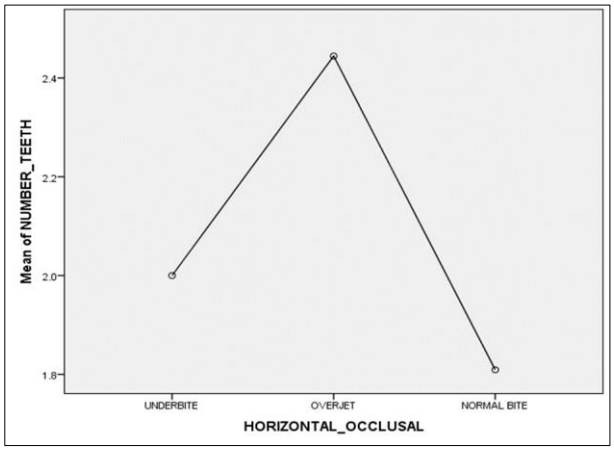

Fig 3: mean number of teeth by horizontal occlusal relationship among the participants

There was no statistically significant association found between single or multiple traumatised teeth and the severity of injury with the molar relationship as well as the horizontal occlusal

relationship. In like manner, there was also no statistically significant relationship between the severity of injury and vertical occlusal relationship among the participants. However, there was a statistically significant association between the number of teeth affected per participant and vertical occlusal relationship among the participants (P=0.04), with a higher proportion of participants with deep bite and open bite having multiple traumatised teeth and a higher proportion of those with normal overbite having a single tooth traumatised (Table 3).

Table 4 shows that there was statistically significant difference in the mean number of traumatised teeth with the different molar relationships (p=0.032), with the mean number of traumatised teeth among participants with Angle's class III significantly higher than among those with Angle's class I and class II division 1.

There was also statistically significant difference in the mean number of traumatised teeth with the different horizontal occlusal relationships (p=0.049), with the mean number of traumatised teeth among participants with increased overjet significantly higher than among those with normal overjet (Figure 3).

Table 5 shows that there was statistically significant difference in the mean number of traumatised teeth with the different vertical occlusal relationship (p=0.006), with the mean number of traumatised teeth among participants with open and deep bite significantly higher than among those with normal bite.

Table 2: Pattern of occlusal traits among the participants

Occlusal traits	Frequency	Percent
Molar relationshipvAngle's class I	222	88.8
Angle's class II division 1	21	8.4
Angle's class II division 2	2	0.8
Angle's class III	5	2.0
Horizontal relationship (Overjet) Reverse overjet	8	3.2
Increased overjet	27	10.8
Normal overjet	215	86.0
Vertical relationship (Overbite) Deep bite	11	4.4
Open bite	22	8.8
Normal overbite	217	86.8
Total	250	100.0

Table 3: Association between occlusal traits and number of traumatised teeth.

Occlusal trait	Number of traumatised teeth		Severity of traumatised teeth			Total n (%)
	Single n (%)	Multiple n (%)	I n (%)	II n (%)	III n (%)	
Molar relationship	P=0.97				0.08	
Angle's class I	110 (49.5)	112 (50.5)	65 (29.3)	135(60.8)	22 (9.9)	222 (100.0)
Angle's class II div 1	11(52.4)	10 (47.6)	9 (42.9)	9 (42.9)	3 (14.3)	21 (100.0)
Angle's class II div 2	1 (50.0)	1 (50.0)	0.(0.0)	1 (50.0)	1 (50.0)	2 (100.0)
Angle's class III	2 (40.0)	3 (60.0)	0 (0.0)	2 (40.0)	2 (40.0)	5 (100.0)
Horizontal relationship	P=0.06				P=0.58	
Reverse overjet	3 (37.5)	5 (62.5)	1 (12.5)	6 (75.0)	1 (12.5)	8 (100.0)
Increased overjet	8 (29.6)	19 (70.4)	8 (29.6)	14 (51.9)	5 (18.5)	27 (100.0)
Normal overjet	113 (52.6)	102 (47.4)	65 (30.2)	128(59.5)	22 (10.2)	215 (100.0)
Vertical relationship	P=0.036				P=0.41	
Deep bite	2 (18.2)	9 (81.8)	1 (9.1)	9 (81.8)	1 (9.1)	11 (100.0)
Open bite	8 (36.4)	14 (63.6)	7 (31.8)	11 (50.0)	4 (18.2)	22 (100.0)
Normal overbite	114 (52.5)	103 (47.5)	66 (30.4)	128(59.0)	23 (10.6)	217 (100.0)
Total	124 (49.6)	126 (50.4)	74 (29.6)	148(59.2)	28 (11.2)	250 (100.0)

*I= no pulpal involvement, II= pulpal involvement, III= avulsion injuries

Table 4: Mean number of teeth by molar relationship (MR) among the participants

MR (I)	MR (J)	MD (I-J)	Std. Error	Sig	95% Confidence interval	
					Lower bound	Upper bound
Class I	Class II D1	-0.015	0.288	0.959	-0.58	0.55
	Class II D2	-1.658	0.896	0.065	-3.42	0.11
	Class III	-1.358	0.570	0.018	-2.48	-0.23
Class II D 1	Class I	0.015	0.288	0.959	-0.55	0.58
	Class II D2	-1.643	0.933	0.080	-3.48	0.20
	Class III	-1.343	0.628	0.033	-2.58	-0.11
Class II D2	Class I	1.658	0.896	0.065	-0.11	3.42
	Class II D1	1.643	0.933	0.080	-0.20	3.48
	Class III	0.300	1.055	0.776	-1.78	2.38
Class III	Class I	1.358	0.570	0.018	0.23	2.48

	Class II D1	1.343	0.628	0.033	0.11	2.58
	Class II D2	-0.300	1.055	0.776	-2.38	1.78

Sum of squares between groups 14.283; Sum of squares within groups 391.353 F =2.99; Sig= 0.032

Table 5: mean number of teeth by vertical occlusal relationship (VOR) among the participants

VOR (I)	VOR (J)	MD (I-J)	Std. Error	Sig	95% Confidence interval	
					Lower bound	Upper bound
Deep	Open	0.455	0.463	0.328	-0.46	1.37
	Normal	1.030	0.388	0.008	0.27	1.79
Open	Deep	-0.455	0.463	0.328	-1.37	0.46
	Normal	0.576	0.281	0.041	0.02	1.13
Normal	Deep	-1.030	0.388	0.008	-1.79	-0.27
	Open	-0.576	0.281	0.041	-1.13	-0.02

Sum of squares between groups 16.660; Sum of squares within groups 388.976 F =5.29; Sig= 0.006

Discussion

Trauma to the anterior teeth is a common occurrence and although, occurrences are high in childhood and adolescence, the incidence in adulthood peaks at 21-30 years [3]. Many studies have been carried out on children to establish the relationship between trauma and certain occlusal traits. The high prevalence of malocclusion and very high cost of orthodontic treatment in our environment influenced this study to know the characteristics of the occlusal traits seen in patients with dental trauma and to know if similar occlusal traits when left untreated in children can predispose to dental trauma of the anterior teeth in adulthood.

This study was designed to assess the relationship between anterior and posterior occlusal traits and characteristics of trauma to the anterior teeth among adult patients who reported to the clinic for reasons other than orthodontic and were diagnosed with one form of traumatic dental injury or the other. The molar, horizontal and vertical occlusal relationships were assessed.

The injury pattern in this study showed that there were more complex injuries involving the pulp and avulsion. This is in consonant with previous findings where adults were observed to have more complex injuries [15]. This maybe because local biological factors may affect injury pattern [15] as the mechanical properties of the teeth and bone differ in adulthood.[16-18]

Although, Angle's class II with increased overjet has been reported as a predisposing factor for dental trauma [3, 19, 21], it was observed in this study that most of the participants had Angle's class I molar relationship with normal overjet and overbite. A finding which is different from that reported in a previous study where a greater number of patients with trauma were found to have class II division 1 malocclusion [22]. This may be due to the high prevalence of Angle's class I malocclusion and normal overjet in our environment [23, 24]. More so, most of the previous studies were done on children and adolescents [19. 20] who are more prone to trauma and traumatic injuries. Also, the aetiology of dental trauma seems to differ between children and adults [15].

Various occlusal traits have been associated with increased dental trauma. Shulman and Peterson [3] observed that the odds of trauma increased with increased overjet while Antunes *et al* [1] reported that increased overjet was three times more likely to be associated with trauma than normal overjet. Overjet can be said to be a predisposing factor for trauma and was found not to Influence the severity of the trauma in this study. This may be because the extent of damage to teeth following dental trauma tends to be determined by the energy and direction of the impact as well as the resilience of the involved structures [15, 25]

The mean number of traumatised teeth (1.88) recorded in this study was lower than that reported by Teshome and Muche (2.31) [26] as well as that by Ruslin (3.55) [27]. In contrast the prevalence of single traumatised tooth (49.6%) observed in this study was noted to be higher than that reported in previous studies [26, 28, 29].

The mean number of traumatised teeth was observed to be associated with molar relationship with the mean number of traumatised teeth among participants with Angle's class III significantly higher. Angle's Class III malocclusion tends to be associated with dental compensations in which the maxillary incisors are excessively flared and the mandibular incisors severely tipped [30] probably making them more prone to trauma.

The mean number of traumatised teeth among participants with increased overjet was observed to be significantly higher. Artun *et al* [31] found a strong association between horizontal occlusal relationship and increasing trauma occurrence. Shulman and Peterson [3] reported that after adjusting for age, overjet was the only occlusal covariate significantly associated with maxillary incisor trauma, with the odds of trauma increasing markedly as overjet increased. It can be inferred based on this finding that overjet is not just a predisposing factor but can influence the mean number of teeth involved in a traumatic injury. This can be attributed to the fact that increased overjet means increased exposure of teeth with inadequate lip protection which predisposes more teeth to trauma [26].

There appears to be contrasting reports in the literature on the association between dental trauma and vertical occlusal relationships [31, 34]. While Bonini *et al* [32] and Oliveira *et al* [33] reported significant relationships between anterior open bite and dental trauma in their studies, Goettems *et al* [34] and Artun *et al* [31] in their studies could not establish any relationship. However, Goettems *et al* [34] were able to establish a relationship between deep bite and dental trauma. Interestingly, a strong link between the vertical occlusal relationship and the mean number of teeth traumatised per participant was noted in this study with the mean number of traumatised teeth significantly higher among participants with open and deep bite.

Conclusion

Occlusal traits have an influence on the mean number of teeth traumatised during a traumatic incident but does not contribute to the severity of dental injuries sustained. There is need therefore, for orthodontic intervention in persons with as part of strategies required to prevent dental trauma.

Limitations

The occlusal traits assessed did not entail the full range of occlusal traits.

Recommendations

Further studies with larger study population assessing more occlusal traits and orthodontic parameters be done.

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