Archives of Orofacial Sciences
The Journal of the School of Dental Sciences
Universiti Sains Malaysia

Arch Orofac Sci (2012), **7**(2): 50-55.

Original Article

Prevalence of dental abfraction among a sample of Sudanese patients

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Revised edition: 13/01/2012. Accepted: 18/07/2012. Published online: 18/07/2012.

Abstract The aims of the present study were to determine the prevalence of dental abfraction among a sample of adult Sudanese patients and to investigate the possible association between abfraction and different etiological factors. The diagnosis of abfraction included both clinical examination and laboratory work. All attended patients were examined for presence of cervical lesion. Complete clinical history was obtained from the examined cases by using self report questionnaire. Impression was taken for cases with suspected abfraction by using additional silicon impression material; a study cast was evaluated for every case. Analysis of the study was conducted by applying an inlay wax over the lesion to produce wax pattern. The wax pattern was evaluated; any pattern that had a wedge shape was considered as an abfraction lesion. Prevalence of dental abfraction was found to be about 9.4%. Males and females were equally affected, mandibular and maxillary premolars are the most frequently affected teeth. There was a direct correlation between abfraction and parafunctional habits.

Keywords: Abfraction, non-carious cervical lesions, parafunctional habits.

Introduction

Non-carious cervical lesions (NCCL) are defined as the loss of tooth substance at the cemento-enamel junction (Mair, 1992). It is generally accepted that initiation and progression of NCCLs have a multi-factorial aetiology, but the relative contributions of the various processes still remain unresolved and a source of scientific debates (Hur *et al*., 2011). Currently, the most widely accepted causes of NCCLs are abfraction and abrasion, while other mechanisms such as erosion and corrosion have also been proposed (Michael *et al*., 2009).

For dental abfractions, the theory suggests that the high occlusal loads cause large cervical stress concentrations, resulting in a disruption of the bonds between the hydroxyapatite crystals and the eventual loss of cervical enamel (Grippo, 1991; Rees and Jagger, 2003).

Dental abfractions are typically wedge shaped (or V-shaped) with sharp line angles, but occlusal abfractions have also been observed as circular invaginations (Owens and Gallien, 1995; Bernhardt *et al*., 2006). Dental abfractions can occur alone and are sometimes associated with toothbrush abrasion and erosion from endogenous or exogenous acids (Tomasik, 2006). Another research suggested that the cause of the V-shaped lesion is due to excessive horizontal tooth brushing which involves occlusal stress, producing cervical cracks that predispose the surface to erosion and abrasion (Bartlett and Shah, 2006). The aim of the present study is to determine the prevalence of dental abfraction among a sample of adult Sudanese patients.

Materials and methods

Study population

Questionnaires were distributed among patients attending the Conservative Dentistry clinics, Faculty of Dentistry, University of Khartoum over a six-month period (from January 2010 to June 2010). The questionnaires were handed out by the first author (KGI) and the respondents were requested to fill out the questionnaires independently. They were guaranteed anonymity and encouraged to contact the author for further assistance, if necessary. All subjects consented to participate in the study (n = 180) and had returned the completed questionnaires. This study was approved by the Dental Research Committee (The Helsinki Accord Committee) of Faculty of Dentistry, University of Khartoum (UK/FD postgraduate no. 85/ Dec. 2009).

Methods

Data were collected through self-report questionnaires and clinical examinations. The self-report questionnaire included questions about the oral hygiene, dietary habits, parafunctional habits which included bruxism, clenching, teeth grinding, tongue biting, lip biting, cheek sucking, and object biting. All subjects were examined by the authors, KGI and NHA. The clinical examination involved detailed inspection of the cervical area of each tooth using a mouth mirror, examination probe and periodontal probe under artificial light source. Diagnosis of abfraction lesion was based on established clinical features plus positive history of possible associated etiological factors. Modified tooth wear index (MTWI) (Fares *et al.*, 2009) was used to measure the dental abfraction (Table 1).

Analysis of the cases

A study cast was evaluated for every abfraction case; impression was taken by using additional silicon impression material (Fast Set, Ivoclar Vivadent AG, Liechtenstein) for all abfraction cases. Analysis of the study cast was conducted by firstly applying a varnish layer over the cervical lesion on the study cast then an inlay wax was placed over the lesion. A wax wire was then placed over the inlay wax pattern to act as a handle for the wax pattern. The wax pattern was evaluated; any pattern that has a wedge shape was considered as an abfraction lesion (Wood *et al*., 2009) (Figure 1).

Analysis of the results

Logistic regression analysis of risk indicators for subject with or without V-shaped lesions was used to determine if the level of abfraction differ significantly across the levels of possible etiological factors (such as gender, age group, para-functional habits). STATA version 8.2 was used to facilitate the computation.

Table 1 Modified tooth wear index (MTWI) for the cervical region

Exact tooth wear index for enamel

Score	Criterion
0	no change of surface contour
1	minimal loss of contour
2	Enamel loss affecting between 10% and one third of the scored surface
3	Enamel loss affecting at least one third but less than two thirds of the scored surface
4	Enamel loss affecting two thirds or more of the scored surface

Exact tooth wear index for dentine

Score	Criterion
0	No dentine exposure
1	Minimal exposure of dentine
2	Dentine loss less than 1 mm deep
3	Defect less than 1-2 mm deep
4	2 mm or more but no pulp exposure
5	Pulp exposure or secondary dentine exposure

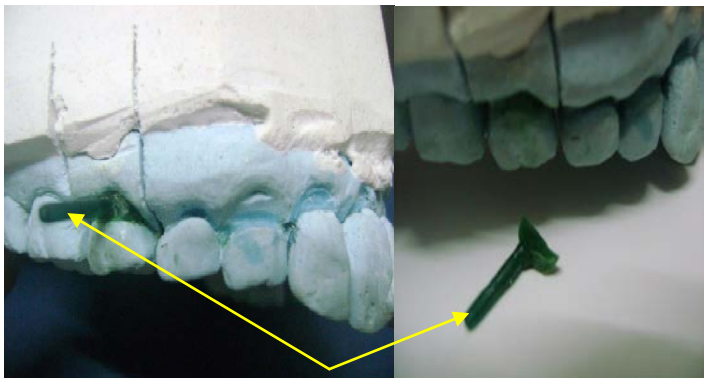

Figure 1: A wedge shaped pattern (arrows) was considered as an abfraction lesion.

Results

A total of 180 patients between the ages of 20-70 years were examined. The majority of the patients were between the ages of 30-40 years old (38%, frequency 68). Fifty nine percent of the samples were females and 41% were males. Seventeen patients were detected with abfraction lesions (9.4%) and were considered as case group with the mean age of 42.2 years, while 163 patients had no abfraction lesion and were considered as control group with the mean age of 45.4 years (Table 2). Table 3 shows the logistic regression analysis of risk indicators for subject with or without abfraction lesions as the dependent variables. The presence of dental abfraction was associated with age group (p=0.004) but not affected by gender.

When asked about parafunctional habits, nine patients (52%) from the case group reported bruxism while 90% of the control group had no parafunctional habit. There was no significant association between brushing direction and the presence of abfraction (p value=0.95). According to the modified tooth wear index (MTWI) (Fares *et al*., 2009), the results showed that the highest frequency of level 2 enamel loss was detected for the first premolar (28 teeth) (Table 4). The highest frequency of level 2 dentine loss was detected for the first premolar (16 teeth) (Table 5).

Table 2 The distribution of age group among case and control groups

Groups	Age group				
	19-30	**31-40**	**41-50**	**51-60**	**61-70**
Control	54(33%)	61(38%)	36(22%)	10(6%)	2(1%)
Case	2(12%)	7(41%)	3(18%)	5(39%)	0(0%)

Significant difference in case vs. control group by Fisher exact test (p = 0.030).

Table 3 Logistic regression analysis of risk indicators for subject with or without abfraction lesions as the dependent variables

Variable	Odds ratio	CI 95% Lower value	CI 95% upper value	*p*-value
Age group				0.16
19-30	-			
31-40	3.1	0.617	15.556	0.17
41-50	2.25	0.358	14.142	0.387
51-60	13.5	2.292	79.512	0.004
61-70	-			
Gender				0.739
Male	-			
Female	0.972	0.352	2.682	0.956
Bruxism				0.001
No	-			
Yes	19.25	6	61.755	0.000
Clenching				0.317
No	-			
Yes	1.21	0.142	10.309	0.861
Teeth grinding				0.793
No	-			
Yes	3.4889	0.646	18.827	0.146
Cheek sucking				
No	-			
Yes	1.876	0.597	5.897	0.282
Brushing direction				0.950
Vertical	-			
Horizontal	0.28	0.032	2.431	0.249

Table 4 The level of dental abfraction for enamel according to MTWI by group of teeth

Class	Total number of teeth																	
	maxilla								mandible								Total	%
	central incisor	lateral incisor	canine	1st premolar	2nd premolar	1st molar	2nd molar	3rd molar	central incisor	lateral incisor	canine	1st premolar	2nd premolar	1st molar	2nd molar	3rd molar		
0	30	30	26	3	13	19	33	34	34	34	31	23	22	32	34	34	432	79.56
1	0	0	4	3	4	6	0	0	0	0	2	5	6	0	0	0	30	5.52
2	4	4	3	28	15	8	1	0	0	0	1	5	5	1	0	0	75	13.81
3	0	0	1	0	1	1	0	0	0	0	0	0	1	0	0	0	4	0.74
4	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	2	0.37
Total	34	34	34	34	33	34	34	34	34	34	34	34	34	34	34	34	543	
%	6.27	6.27	6.27	6.27	6.09	6.27	6.27	6.27	6.27	6.27	6.27	6.27	6.27	6.27	6.27	6.27		100

Table 5 The level of dental abfraction for dentineaccording to MTWI by group of teeth

Class	Total number of teeth																	
	maxilla								mandible								Total	%
	central incisor	lateral incisor	canine	1st premolar	2nd premolar	1st molar	2nd molar	3rd molar	central incisor	lateral incisor	canine	1st premolar	2nd premolar	1st molar	2nd molar	3rd molar		
0	30	30	28	5	14	24	33	34	34	34	30	24	27	32	34	34	44	82.3
1	0	0	5	3	3	0	0	0	0	0	3	4	2	0	0	0	20	3.68
2	1	4	1	15	9	5	1	0	0	0	1	4	4	1	0	0	46	8.47
3	2	0	0	10	6	5	0	0	0	0	0	2	1	0	0	0	26	4.80
4	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	3	0.55
5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.18
Total	34	34	34	34	33	34	34	34	34	34	34	34	34	34	34	34	54	
%	6.27	6.27	6.27	6.27	6.09	6.27	6.27	6.27	6.27	6.27	6.27	6.27	6.27	6.27	6.27	6.27	3	100

Discussion

The different range of prevalence between 5% to 85% for non-carious cervical lesions is highly discrepant especially for abfraction and is determined by defect criteria of the morphology (Faye *et al*., 2005; Oginni *et al*., 2003; Levitch *et al*., 1994). The present investigation showed that in a limited sample of Sudanese patients the prevalence of abfraction was 9.4%. The prevalence of dental abfraction was not largely reported due to the fact that the border lines between dental abfraction and dental abrasion were not quite obvious (Dzakovich and Oslak, 2008). Hur *et al*. (2011*)* reported that none of the samples in his study showed a blunt enamel margin at the occlusal wall as would have been expected according to the abfraction theory, although they examined just fifty teeth.

Abfraction as a cause of non-carious cervical lesion should not be neglected. The clinical finding of this non carious cervical lesion also includes sharp internal and external line angle in addition to the fact that the lesion may be isolated (bounded by non-affected teeth) (Michael *et al.,* 2009). Associations between oral hygiene, consumption of acidic drinks, status of periodontium, number of teeth, their mobility and aetiology of wedge-shaped defects were revealed; also a relationship between lateral excursive contact of teeth, bruxism, and formation of cervical lesions was established evidencing a correlation between occlusal and cervical pathology (Wood *et al* 2009). Abfraction, representing the microstructural loss of tooth substance in areas of stress concentration, should not be used to designate all NCCLs because these lesions are commonly multifactorial in origin (Grippo *et al*., 2012). The data from the present study (Table 3) support the premise that these lesions most often are multifactorial in origin such as bruxism and are not due to a single mechanism (Bernhardt *et al*., 2006). The aetiological factors recorded in the present study came into agreement with the previous determination that support the hypotheses that tooth brushing and a high occlusal load play a role in the aetiology of abfractions (Takehara *et al*., 2008). More than half of the abfraction cases were reported with a bruxism and this support the fact that abfraction is associated with parafunctional habits like bruxism (Tsiggos *et al*., 2008).

The technique used to diagnose abfraction in the present study includes clinical examination and laboratory work. Previously, in clinical based examinations, abfraction cases were identified by using the artificial light source, dental mirror and periodontal probe (Aw *et al*., 2002; Lee and Eakle, 1984). Additionally, Wood *et al.* (2009) had conducted laboratory work utilizing the wax pattern technique and as adopted in the present study, the technique proved to be essential in guiding the researchers to the presence of clear cases of abfraction.

Occlusion is an important factor that determine force direction (Wood *et al*., 2009). The abfraction cases with an abnormal occlusion and associated with occlusal wear facets in the present study coincided with the findings by Miller *et al.* (2003).

Cervical lesion with indices levels of 2, 3 and 4 indicated the presences of a well formed cervical lesion. The highest frequency of level 2 was found for the first lower premolars in the present study has come into agreement with the findings by Borcic *et al*. (2004), where premolars scored the highest rate of abfraction cases. The modified tooth wear index according to Fares *et al*. (2009) showed that grade 2 in enamel affecting between 10% and one third of the scored surface. In the present investigation, grade 2 was found in majority of the abfraction cases for both enamel and dentine.

Conclusion

Within the limitations of this study, the prevalence of dental abfraction in Sudanese people is about 9.4%. Dental abfraction found in young adults, males and females are equally affected, and the risk increased with age. The modified MTWI seems to be an effective tool for use in broad epidemiological surveys, due to easier calibration and high reproducibility rates. Maxillary and mandibular premolars are most frequently affected by dental abfractions.

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