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Pattern of Tooth Wear Lesions and Associated Risk Factors among Adults in Port Harcourt

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Abstract

Background: The prevalence of tooth wear lesions is influenced by geographical location, socio-demographic factors and lifestyle factors/habits. The aim of this study was to determine the pattern of tooth wear lesions amongst patients presenting to the Oral Diagnosis Clinic of the Dental Centre, University of Port Harcourt Teaching Hospital, and assess the associated factors that predispose to tooth wear. **Methods:** This was a prospective cross-sectional study carried out over a period of 3 months involving subjects aged 18 years and above, who consented to participate in the study, and had at least 20 teeth in the mouth. Socio-demographic data and information on lifestyle factors and oral health practices that may predispose to tooth wear were collected using a self-administered questionnaire. Thereafter, subjects were examined for the presence of tooth wear. Ethical approval was obtained from the Ethics and Research Committee of the University of Port Harcourt Teaching Hospital. Data was analyzed using SPSS version 25. $p < 0.05$ was considered statistically significant. **Results:** This study examined 4203 teeth in 136 subjects, and found the overall prevalence of tooth wear lesions in this population and among the teeth examined to be 40.4% and 24.0%, respectively. Attrition was the most common tooth wear lesion, with a prevalence of 36.0%, and this prevalence increased with age. Molars were the most affected, while canines were the least affected teeth. It was uncommon in those below 30 years. Attrition was significantly associated with age ($p = 0.000$), marital status ($p = 0.000$), tooth cleaning aid ($p = 0.003$) and frequency of changing toothbrush ($p = 0.012$). Abrasion and erosion each had a prevalence of 9.6%, with a similar increase in prevalence with advancing age. Both lesions were mostly seen in molar teeth. While abrasion had a significant association with age ($p = 0.003$), marital status ($p = 0.000$), tooth cleaning aid ($p = 0.026$) and tooth grinding habits ($p = 0.030$), erosion was significantly associated with age ($p = 0.001$), frequency of toothbrushing ($p = 0.006$), and last dental

visit ($p = 0.017$). Abfraction was the least common tooth wear lesion and was associated with tooth grinding habit ($p = 0.003$). **Conclusion:** Tooth wear lesions in Port Harcourt are uncommon in those below 30 years, with the prevalence increasing steadily thereafter. Attrition is the most common tooth wear lesion, and tooth wear lesions mostly affected the molar teeth. Predictors of tooth wear lesions were increasing age, being married or widowed, using powder to brush the teeth, using the same toothbrush for more than 4 months, and tooth grinding habits.

Keywords

Tooth Wear, Attrition, Abrasion, Erosion, Abfraction, Port Harcourt

1. Introduction

The human teeth are composed structurally of a soft connective tissue (pulp) enclosed within hard tissues (enamel, dentine and cementum). The bulk of the tooth is made up of dentin, on the root portion of a tooth, dentin is covered by cementum, while in the crown, it is covered by enamel, which is the hardest substance in the human body [1] [2]. Since the teeth function mainly in mastication, some degree of tooth wear is considered normal. Under normal circumstances, enamel wears at a rate of 10 - 40 μm/year, which is relatively insignificant [3]. However, the rate of tooth wear may be accelerated by the type of diet, para-functional habits or other pathologies. The term "tooth wear" is used to represent all types of non-carious tooth substance loss and includes attrition, abrasion, erosion and abfraction [4] [5].

Attrition is the loss of hard tooth substance as a result of tooth-to-tooth contact. It is mostly seen on the occlusal surfaces of the posterior teeth and is frequently attributed to rough diets, tooth grinding habits and lack of posterior tooth support [4] [5]. Abrasion is the loss of hard tooth substance as a result of contact between the teeth and an external mechanical object. It is mainly attributed to the use of excessive force during toothbrushing, alongside hard-bristled toothbrushes and dentifrices with high abrasive contents [6]. Abrasive lesions are mostly seen as V-shaped notches in the cervical areas of the facial surfaces of the teeth [4]. Erosion is the loss of hard tooth substance due to a non-bacterial chemical process, involving the dissolution of the tooth structure by acids. The acids may be from intrinsic or extrinsic sources [4] [5]. Erosion mostly affects the facial and palatal surfaces of the maxillary anterior teeth and the facial and occlusal surfaces of the mandibular posterior teeth [4].

The aetiology of tooth wear is multifactorial, with dietary/lifestyle and parafunctional habits implicated. Systemic conditions (e.g. gastro-oesophageal reflux disease), medications, and socio-demographic factors (e.g. age, occupation) have also been linked to the aetiology of tooth wear [7]. The global prevalence of tooth wear lesions is estimated to be 38% [2], with studies from Nigeria showing a prev-

alence of 53.0% - 93.3% [8]-[11]. Many studies in the literature have reported dental erosion as the most common tooth wear lesion. This has been attributed mainly to the frequent consumption of acidic beverages and fruit juices, or reflux of acidic gastric contents into the mouth [2] [7] [12] [13]. However, studies from Africa [8]-[11] and some parts of Asia [7] have found attrition to be the most common tooth wear lesion.

The prevalence of tooth wear lesions is influenced by geographical location, socio-demographic factors and lifestyle factors/habits [2] [7]. Thus, there is a need to establish the prevalence of tooth wear lesions in a particular location and determine the antecedent factors, as this will help guide both preventive and therapeutic approaches to the management of tooth wear. Port Harcourt is a major city in Nigeria, and the most densely populated city in the south-south geopolitical zone. It has a diverse population that can give a fair representation of a variety of Nigerian people, their culture and practices. Previous studies on tooth wear in Port Harcourt have focused only on the elderly [8] [14]. However, tooth wear is not restricted to the elderly, with changing dietary habits and oral hygiene practices playing a significant role in the aetiology and type of tooth wear, especially among younger adults.

Therefore, the aim of this study was to determine the pattern of tooth wear lesions amongst patients presenting to the Oral Diagnosis Clinic of the Dental Centre, University of Port Harcourt Teaching Hospital, and assess the associated factors that predispose to tooth wear.

2. Methods

This was a prospective cross-sectional study conducted at the Oral Diagnosis Clinic of the Dental Centre, University of Port Harcourt Teaching Hospital over a period of 3 months (January 2023 to March 2023). All new patients aged 18 years and above were eligible to participate in this study. The study objectives were explained to prospective participants, following which informed consent was sought. Only those who gave consent and had at least 20 teeth (10 anterior and 10 posterior teeth) present in the mouth were enlisted into the study. Exclusion criteria included those less than 18 years of age, those with less than 20 teeth in the mouth, and teeth with full coverage restorations were also excluded from the study. Ethical approval for this study was obtained from the Ethics and Research Committee of the University of Port Harcourt Teaching Hospital (Protocol number: UPTH/ADM/90/S.ll/VOL.Xl/1620). Data was obtained using a self-administered questionnaire, and through oral examination.

The questionnaire was developed by adopting and refining questions from those used in previous studies. Face validation of the questionnaire was done by an expert reviewer. Thereafter, the questionnaire was pre-tested on a subset of the study population, and the responses analyzed for validity and reliability. The questionnaire consisted of three sections. Section A elicited socio-demographic information (age, gender, marital status and level of education). Section B elicited in-

formation on lifestyle factors and oral health practices that may predispose to tooth wear (last dental visit, frequency and time of cleaning teeth, tooth cleaning aid used, texture of toothbrush, toothbrushing method, frequency of changing toothbrush, intake of carbonated drinks and citrus fruits, tooth grinding and jaw clenching habits as well as frequent biting on objects). Section C consisted of a scoring chart that was used to record the teeth affected by tooth wear. Oral examination was carried out by the same examiner under adequate illumination with the patient seated on a dental chair. Tooth wear lesions were identified using the guidelines described by Kelleher and Bishop [15]. Data analysis was done using SPSS version 25. Chi-square statistics was used to determine the level of association between tooth wear lesions and other variables, with $p < 0.05$ considered statistically significant.

3. Results

During the period of the study, 152 persons met the eligibility criteria and were enrolled into the study. Of these, 16 cases had incomplete information and were thus excluded from the analysis, leaving a remainder of 136 subjects that formed the study participants. This study examined 4203 teeth in the 136 subjects. The overall prevalence of tooth wear lesions in this population and the among the teeth examined was 40.4% and 24.0%, respectively. The age of the participants ranged from 18 - 77 years, with a mean age of 40.2 ± 16.7 years. There were more female participants (57.4%) than male participants (42.6%).

Attrition was the most common tooth wear lesion encountered in this study. It had a prevalence of 36.0% among the study subjects, and a prevalence of 19.0% among the teeth examined. Attrition was uncommon in those below 30 years of age. Thereafter, the prevalence increased steadily until old age (Table 1). The teeth most frequently affected by attrition were the molars, while the canines were the least affected (Table 2). There were statistically significant associations between attrition and age ($p = 0.000$), marital status ($p = 0.000$), tooth cleaning aid ($p = 0.003$) and frequency of changing toothbrush ($p = 0.012$).

Abrasion was seen in 9.6% of the study subjects, and in 3.6% of the teeth examined, making it the second most common tooth wear lesion in this study. It was mostly seen in females, and in those above 30 years. Similar to attrition, abrasion involved mostly the molars. There were statistically significant associations between abrasion and age ($p = 0.003$), marital status ($p = 0.000$), tooth cleaning aid ($p = 0.026$) and tooth grinding habits ($p = 0.030$). The relationship between abrasion and frequency of toothbrushing ($p = 0.105$), texture of toothbrush ($p = 0.271$), toothbrushing method ($p = 0.709$) and habitual biting on objects ($p = 0.402$) was not statistically significant (Table 3).

Similar to abrasion, erosion was seen in 9.6% of the study subjects, but it occurred in a lower percentage of the teeth examined (1.4%). It was seen only in those aged 40 years and above. Age ($p = 0.001$), frequency of toothbrushing ($p = 0.006$), and last dental visit ($p = 0.017$) were the variables significantly associated with

Table 1. Relationship between tooth wear and socio-demographics.

Socio-demographic characteristic	Attrition			Abrasion			Erosion		
	Yes	No	*p*	Yes	No	*p*	Yes	No	*p*
Age group									
<20	1 (9.1)	10 (90.9)		0 (0)	11 (100)		0 (0)	11 (100)	
20 - 29	1 (3.2)	30 (96.8)		0 (0)	31 (100)		0 (0)	31 (100)	
30 - 39	9 (30.0)	21 (70.0)		1 (3.3)	29 (96.7)		0 (0)	30 (100)	
40 - 49	10 (34.5)	19 (65.5)	*0*	3 (10.3)	26 (89.7)	*0.003*	4 (13.8)	25 (86.2)	*0.001*
50 - 59	7 (70.0)	3 (30.0)		2 (20.0)	8 (80.0)		4 (40)	6 (60)	
60 - 69	13 (86.7)	2 (13.3)		3 (20.0)	12 (80.0)		3 (20)	12 (80.0)	
70 - 79	8 (80.0)	2 (20.0)		4 (40.0)	6 (60.0)		2 (20)	8 (80.0)	
Gender									
Male	20 (34.5)	38 (65.5)	*0.444*	4 (6.9)	54 (93.1)	*0.557*	4 (6.9)	54 (93.1)	*0.557*
Female	29 (37.2)	49 (62.8)		9 (11.5)	69 (88.5)		9 (11.5)	69 (88.5)	
Marital status									
Single	5 (9.4)	48 (90.6)		0 (0)	53 (100)		2 (3.8)	51 (96.2)	
Married	38 (50.0)	38 (50.0)	*0*	10 (13.2)	66 (86.8)	*0*	11 (14.5)	65 (85.5)	*0.086*
Widowed	6 (85.7)	1 (14.3)		3 (42.9)	4 (57.1)		0 (0)	7 (100)	
Level of education									
Primary	3 (100)	0 (0)		1 (33.3)	2 (66.7)		1 (33.3)	2 (66.7)	
Secondary	12 (30.8)	27 (69.2)	*0.055*	3 (7.7)	36 (92.3)	*0.347*	3 (7.7)	36 (92.3)	*0.347*
Tertiary	34 (36.2)	60 (63.8)		9 (9.6)	85 (90.4)		9 (9.6)	85 (90.4)	

Table 2. Distribution of tooth wear in the maxilla and mandible.

Tooth type	Maxilla, n (%)	Mandible, n (%)	Total, n (%)
Attrition			
Incisors	65 (8.1)	78 (9.8)	143 (17.9)
Canine	35 (4.4)	41 (5.1)	76 (9.5)
Premolar	92 (11.5)	97 (12.1)	189 (23.7)
Molar	197 (24.7)	194 (24.3)	391 (48.9)
Total	**389 (48.7)**	**410 (51.3)**	**799 (100)**
Abrasion			
Incisors	19 (12.7)	16 (10.7)	35 (23.3)
Canine	13 (8.7)	10 (6.7)	23 (15.3)
Premolar	25 (16.7)	19 (12.7)	44 (29.3)
Molar	26 (17.3)	22 (14.7)	48 (32.0)

Continued

Total	**83 (55.3)**	**67 (44.7)**	**150 (100)**
Erosion			
Incisors	1 (1.7)	2 (3.4)	3 (5.2)
Canine	1 (1.7)	5 (8.6)	6 (10.3)
Premolar	10 (17.2)	10 (17.2)	20 (34.5)
Molar	12 (20.7)	17 (29.3)	29 (50.0)
Total	**24 (41.4)**	**34 (58.6)**	**58 (100)**

Table 3. Relationship between tooth wear and oral habits/lifestyle practices.

Variables	Attrition			Abrasion			Erosion		
	Yes	No	*p*	Yes	No	*p*	Yes	No	*p*
Last dental visit									
<6 months	4 (44.4)	5 (55.6)		1 (11.1)	8 (88.9)		0 (0)	9 (100)	
6 - 12 months	4 (18.2)	18 (81.8)	*0.177*	2 (9.1)	20 (90.9)	*0.916*	2 (9.1)	20 (90.9)	*0.017*
>12 months	23 (44.2)	29 55.8)		6 (11.5)	46 (88.5)		10 (19.2)	42 (80.8)	
Frequency of cleaning teeth									
Once daily	36 (36.0)	64 (64.0)	*0.99*	7 (7.0)	93 (93.0)	*0.105*	5 (5.0)	85 (95.0)	*0.006*
Twice daily	13 (36.1)	23 (63.9)		6 (16.7)	30 (83.3)		8 (22.2)	28 (77.8)	
Time of cleaning teeth									
Morning before breakfast	46 (36.8)	79 (63.2)	*0.746*	13 (10.4)	112 (89.6)	*0.599*	13 (10.4)	112 (89.6)	*0.599*
Morning after breakfast	3 (27.3)	8 (72.7)		0 (0)	11 (100)		0 (0)	11 (100)	
Tooth cleaning aid									
Toothbrush and toothpaste	36 (31.3)	81 (69.2)	*0.003*	8 (6.8)	109 (93.2)	*0.026*	11 (9.4)	106 (90.6)	*0.142*
Toothbrush and dental powder	13 (68.4)	6 (31.6)		5 (26.3)	14 (73.7)		2 (10.5)	17 (89.5)	
Texture of toothbrush									
Soft	13 (48.1)	14 (51.9)		5 (18.5)	22 (81.5)		1 (3.7)	26 (96.3)	
Medium	23 (29.1)	56 (70.9)	*0.18*	7 (8.9)	72 (91.1)	*0.271*	10 (12.7)	69 (87.3)	*0.514*
Hard	13 (44.8)	16 (55.2)		1 (3.4)	28 (96.6)		2 (6.9)	27 (93.1)	
Toothbrushing method									
Forward and backward	43 (40.6)	63 (59.4)		12 (11.3)	94 (88.7)		12 (11.3)	94 (88.7)	
Up and down	6 (25.0)	18 (75.0)	*0.061*	1 (4.2)	23 (95.8)	*0.402*	1 (4.2)	23 (95.8)	*0.402*
Roll	0 (0)	6 (100)		0 (0)	6 100)		0 (0)	6 (100)	
Frequency of changing toothbrush									
1 - 3 months	18 (25.7)	52 (74.3)	*0.012*	6 (8.6)	64 (91.4)	*0.775*	6 (8.6)	64 (91.4)	*0.775*
≥4 months	31 (47.0)	35 (53.0)		7 (10.6)	59 (89.4)		7 (10.6)	59 (89.4)	

Continued

Carbonated drinks									
Daily	6 (30.0)	14 (70.0)		1 (5.0)	19 (95)		1 (5.0)	19 (95.0)	
Once a week	14 (36.8)	24 (63.2)	*0.583*	4 (10.5)	34 (89.5)	*0.507*	3 (7.9)	35 (92.1)	*0.831*
Occasionally	15 (31.3)	33 (68.8)		7 (14.6)	41 (85.4)		6 (12.5)	42 (87.5)	
Never	2 (66.7)	1 (33.3)		0 (0)	3 (100)		0 (0)	3 (100)	
Consumption of citrus fruits									
Yes	27 (31.0)	60 (69.0)	*0.077*	9 (10.3)	78 (89.7)	*0.77*	7 (8.0)	80 (92.0)	*0.545*
No	22 (44.9)	27 (55.1)		4 (8.2)	45 (91.8)		6 (12.2)	43 (87.8)	
Tooth grinding habits									
Yes	7 (50.0)	7 (50.0)	*0.257*	4 (28.6)	10 (71.4)	*0.03*	1 (7.1)	13 (92.9)	*0.745*
No	42 (34.4)	80 (65.6)		9 (7.4)	113 (92.6)		12 (9.8)	110 (90.2)	
Jaw clenching									
Yes	6 (42.9)	8 (57.1)	*0.57*	3 (21.4)	11 (78.6)	*0.133*	1 (7.1)	13 (92.9)	*0.745*
No	43 (35.2)	79 (64.8)		10 (8.2)	112 (91.8)		12 (9.8)	110 (90.2)	
Biting on objects									
Yes	2 (33.3)	4 (66.7)	*0.888*	0 (0)	6 (100)	*0.415*	0 (0)	6 (100)	*0.415*
No	47 (36.2)	83 (63.8)		13 (10.0)	117 (90.0)		13 (10.0)	117 (90.0)	

erosion. Consumption of carbonated drinks ($p = 0.831$) was not significantly associated with erosion. Abfraction was the tooth wear lesion least encountered in this study, affecting just one (0.7%) subject, and 0.05% of the teeth examined. It was significantly associated with tooth grinding habit ($p = 0.003$).

4. Discussion

This study investigated the pattern of tooth wear lesions as well as the factors that predispose to tooth wear amongst adult patients presenting to the dental clinic of the University of Port Harcourt Teaching Hospital. We found that the prevalence of tooth wear lesions increased with age, and that molar teeth were most often affected. Factors that predispose to tooth wear were being married or widowed, using powder to brush the teeth, using the same toothbrush for more than 4 months, and tooth grinding habits.

The overall prevalence of tooth wear in this study was 40.4%, which is similar to the estimated global prevalence of 38% reported by Azeez *et al.* [2] in a systematic review. Attrition was the most common TW lesion in this study, which is similar to previous findings in the literature [8] [16] [17], with a prevalence of 36.0%. This is comparable to the 34% and 40% previously reported by Ibiyemi *et al.* [9] and Ogunrinde *et al.* [18] respectively in Nigerians. Other Nigerian authors have much higher figures, but these studies were carried out among the elderly [8] [11]. In some Caucasian studies [19] [20], attrition was less prevalent than erosion among

the tooth wear lesions. The high prevalence of attrition in Nigerians has been attributed to the more fibrous nature of the diet, as well as the use of chewing sticks for oral hygiene [16] [21]. African diets also frequently contain nuts and chewing of such nuts contribute to both attrition and abrasion [2].

Attrition was significantly associated with increasing age and being married or widowed, which may be attributed to the influence of age, since the married/widowed are more likely to be older than single people. Many studies have corroborated a higher prevalence of tooth wear lesions with increasing age, and amongst married people [9] [10] [14] [16]. Attrition was also significantly associated with the use of toothbrush with dental powder and using the same toothbrush for 4 months or longer. These findings may be explained by the inter-related factors in the aetiology of tooth wear, with more than one type of tooth wear lesion often occurring on the same tooth [11]. Previous studies have noted the frequent co-existence of multiple tooth wear lesions on the same tooth [9] [11] [22]. Ruis-Bonet and co-workers [22] reported that erosion was a strong predictor of attrition. There was no association between attrition and gender in our study, similar to the findings of Savage *et al.* [10]; although Oginni *et al.* [16] found tooth wear lesions to be more frequent in males. Attrition affected mainly the molars (48.9%), with almost identical affectation of the maxillary and mandibular molars, while the canines were the teeth least affected. Similar findings were reported by other authors [11]. The molar teeth have the greatest surface area for tooth-to-tooth contact, hence the higher occurrence of attrition in molars [23].

Abrasion was the second most common tooth wear lesion in this study, as has been reported by previous Nigerian studies [10] [11] [18] [21]. It was significantly associated with increasing age. This is due to the cumulative effects of tooth wear with ageing, especially since the enamel of the teeth is not replaced once lost. Abrasion was significantly more in those who cleaned their teeth with tooth brush and powder. Such powders used in cleaning the teeth are often locally prepared and are more abrasive compared to the regular toothpastes [10], as toothpastes with higher abrasive contents are known to cause more tooth wear [24]. Contrary to the findings of some previous studies [10] [11], this study did not find any association between abrasion and the frequency of toothbrushing, texture of toothbrush, and toothbrushing method. In a study in Pakistan, Toufique *et al.* [25] also did not find any significant relationship between tooth wear and the type of toothbrush used or the frequency of brushing the teeth. Other authors have also had similar reports [26] [27]. Abrasion affected the molars slightly more than the premolars in this study, which is in contrast to the findings of Oginni *et al.* [16] were the prevalence of abrasion was more in premolars. The use of highly abrasive powders for toothbrushing may explain the distribution of abrasion in the current study. In a previous study [16], those with abrasion had positive history of horizontal tooth brushing technique, use of firm/hard toothbrush, and excessive brushing force. In our study, although these factors were also seen in those with abrasion, the relationship was not statistically significant.

Erosion was less common than attrition and abrasion in this study, as has been reported by other Nigerian authors [8] [21]. Studies from other parts of the world have reported erosion to be the most common tooth wear lesion [2]. Erosion was seen only in those aged 40 years and above. This contrasts the findings of some Caucasian studies in which erosion was seen mostly in young adults [4]. Frequent consumption of carbonated drinks and other acidic beverages have typically been associated with increased incidence of erosion [4], and such behaviours are more common in adolescents and young adults [15]. However, in this study, consumption of carbonated drinks was not significantly associated with erosion. Similarly, Ruis-Bonet *et al*. [22] did not find significant associations between gastric reflux, acidic diet and frequency of brushing on the occurrence of tooth wear. This study also showed that those who visited the dental clinic more regularly were less likely to have erosion. This is because such visits to the dentist offer opportunities for counselling and oral health education, enabling such individuals to adopt healthier oral health and lifestyle practices that may potentially protect against erosion. Those who cleaned their teeth twice daily were more likely to have erosion compared to those who cleaned only once. This may be the result of cleaning immediately after consumption of acidic beverages. In such situations, an interplay of abrasion may worsen any erosive lesions already present [28].

Abfraction was the least common tooth wear lesion in this study, which is similar to the findings of other authors [8] [11] [18], and was significantly associated with tooth grinding habit. Indeed, abfraction has been attributed to mechanical overloading with subsequent flexure of the tooth [29]. Such mechanical forces may be associated with the habitual grinding of teeth.

5. Conclusion

Tooth wear lesions in Port Harcourt are uncommon in those below 30 years, with the prevalence increasing steadily thereafter. They affect mostly the molar teeth, with attrition being the most common tooth wear lesion. Predictors of tooth wear lesions include increasing age, being married or widowed, using powder to brush the teeth, using the same toothbrush for more than 4 months, and tooth grinding habits.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Nanci, A. (2007) Ten Cate's Oral Histology-Pageburst on Vitalsource: Development, Structure, and Function. Elsevier Health Sciences.

[2] Azeez, A.A., Sherif, S. and França, R. (2021) Statistical Estimation of Wear in Permanent Teeth: A Systematic Review. *Dentistry Review*, **1**, Article ID: 100001. https://doi.org/10.1016/j.dentre.2021.100001

[3] Sajewicz, E. (2006) On Evaluation of Wear Resistance of Tooth Enamel and Dental Materials. *Wear*, **260**, 1256-1261. https://doi.org/10.1016/j.wear.2005.08.010

[4] Warreth, A., Abuhijleh, E., Almaghribi, M.A., Mahwal, G. and Ashawish, A. (2020) Tooth Surface Loss: A Review of Literature. *The Saudi Dental Journal*, **32**, 53-60. https://doi.org/10.1016/j.sdentj.2019.09.004

[5] Pareek, A., Sood, H. and Aggarwal, G. (2021) Tooth Wear: A Review. *International Journal of Health Sciences*, **5**, 122-133. https://doi.org/10.53730/ijhs.v5nS1.5405

[6] Litonjua, L.A., Andreana, S. and Cohen, R.E. (2005) Toothbrush Abrasions and Non-carious Cervical Lesions: Evolving Concepts. *Compendium of Continuing Education in Dentistry*, **26**, 767-768, 770-774, 776.

[7] Devanathan, N., Hegde, M.N., Shetty, S. and Sadananda, V. (2018) Prevalence of Tooth Wear due to Dietary Factors in Population of South Karnataka. *European Journal of Biomedical and Pharmaceutical Sciences*, **5**, 616-619.

[8] Braimoh, O.B. and Alade, G.O. (2018) Prevalence and Distribution of Tooth Wear in an Elderly Cohort in Port Harcourt, Nigeria. *Journal of Dental Research and Reviews*, **5**, 80-83. https://doi.org/10.4103/jdrr.jdrr_37_18

[9] Ibiyemi, O. and Taiwo, J.O. (2012) Some Socio-Demographic Attributes as Covariates in Tooth Wear among Males in a Rural Community in Nigeria. *Ethiopian Journal of Health Sciences*, **22**, 189-195.

[10] Savage, K.O., Oderinu, O.H., Adegbulugbe, I.C., Uti, O.G., Dosumu, O.O. and Olusile, A.O. (2018) A National Survey of Tooth Wear on Facial and Oral Surfaces and Risk Factors in Young Nigerian Adults. *European Journal of Dentistry*, **12**, 292-299. https://doi.org/10.4103/ejd.ejd_92_17

[11] Ipeaiyeda, O.J., Taiwo, J.O. and Lawal, F.B. (2023) The Impact of Tooth Wear on the Oral Health-Related Quality of Life of the Elderly in Ibadan, Nigeria. *Nigerian Medical Journal*, **64**, 327-336.

[12] Bartlett, D.W., Lussi, A., West, N.X., Bouchard, P., Sanz, M. and Bourgeois, D. (2013) Prevalence of Tooth Wear on Buccal and Lingual Surfaces and Possible Risk Factors in Young European Adults. *Journal of Dentistry*, **41**, 1007-1013. https://doi.org/10.1016/j.jdent.2013.08.018

[13] Smith, B.G.N. and Knight, J.K. (1984) A Comparison of Patterns of Tooth Wear with Aetiological Factors. *British Dental Journal*, **157**, 16-19. https://doi.org/10.1038/sj.bdj.4805401

[14] Braimoh, O.B. and Alade, G.O. (2018) Oral Habits and Sociodemographic Factors as Determinants of Tooth Wear Lesions among the Elderly Population in Port Harcourt, Nigeria. *International Journal of Community Dentistry*, **6**, 30-35.

[15] Kelleher, M. and Bishop, K. (1999) Tooth Surface Loss: An Overview. *British Dental Journal*, **186**, 61-66. https://doi.org/10.1038/sj.bdj.4800020a1

[16] Oginni, O. and Olusile, A.O. (2002) The Prevalence, Aetiology and Clinical Appearance of Tooth Wear: The Nigerian Experience. *International Dental Journal*, **52**, 268-272. https://doi.org/10.1111/j.1875-595X.2002.tb00629.x

[17] Sunny, O.A., Philip, O.U. and Amaechi, U.A. (2015) Risk Factors for Tooth Wear Lesions among Patients Attending the Dental Clinic of a Nigerian Teaching Hospital, Benin City: A Pilot Study. *Sahel Medical Journal*, **18**, 188-191. https://doi.org/10.4103/1118-8561.176587

[18] Ogunrinde, T., Ajayi, D. and Abiodun-Solanke, I. (2020) Impact of Tooth Surface Loss on the Quality of Life of Patients Seen in a Nigerian Teaching Hospital. *Open Journal of Stomatology*, **10**, 50-60. https://doi.org/10.4236/ojst.2020.104007

[19] Johansson, A.K., Omar, R., Carlsson, G.E. and Johansson, A. (2012) Dental Erosion and Its Growing Importance in Clinical Practice: From Past to Present. *International*

Journal of Dentistry, **2012**, Article ID: 632907. https://doi.org/10.1155/2012/632907

[20] Smith, B.G. and Robb, N.D. (1996) The Prevalence of Tooth Wear in 1007 Dental Patients. *Journal of Oral Rehabilitation*, 23, 232-239. https://doi.org/10.1111/j.1365-2842.1996.tb00846.x

[21] Ibiyemi, O., Oketade, I.O., Taiwo, J.O. and Oke, G.A. (2010) Oral Habits and Tooth Wear Lesions among Rural Adult Males in Nigeria. *Archives of Orofacial Sciences*, **5**, 31-35.

[22] Rius-Bonet, O., Roca-Obis, P., Zamora-Olave, C., Willaert, E. and Martinez-Gomis, J. (2024) Diagnostic Accuracy of Clinical Signs to Detect Erosive Tooth Wear in Its Early Phase. *Journal of Oral Rehabilitation*, **51**, 861-869. https://doi.org/10.1111/joor.13653

[23] Yurkstas, A. and Manly, R.S. (1949) Measurement of Occlusal Contact Area Effective in Mastication. *American Journal of Orthodontics*, **35**, 185-195. https://doi.org/10.1016/0002-9416(49)90028-7

[24] Lippert, F., Arrageg, M.A., Eckert, G.J. and Hara, A.T. (2017) Interaction between Toothpaste Abrasivity and Toothbrush Filament Stiffness on the Development of Erosive/Abrasive Lesions *in Vitro*. *International Dental Journal*, **67**, 344-350. https://doi.org/10.1111/idj.12305

[25] Toufique, H., Nisar, N. and Saadat, S. (2017) Tooth Wear and Its Related Factors: Findings from A Hospital Based Study. *Pakistan Oral & Dental Journal*, **37**, 459-464.

[26] Atalay, C.A. and Ozgunaltay, G. (2018) Evaluation of Tooth Wear and Associated Risk Factors: A Matched Case-Control Study. *Nigerian Journal of Clinical Practice*, **21**, 1607-1614. https://doi.org/10.4103/njcp.njcp_203_18

[27] Iqbal, Q., Khan, M.W., Nawaz, M.S., Khawaja, H., Akram, M. and Mahmood, H.N. (2022) Causative Factors of Tooth Wear among Patients Visiting a Tertiary Care Hospital in Lahore. *Pakistan Journal of Medical & Health Sciences*, **16**, 198-200. https://doi.org/10.53350/pjmhs22169198

[28] Addy, M. and Shellis, R. (2006) Interaction between Attrition, Abrasion and Erosion in Tooth Wear. *Monographs in Oral Science*, **20**, 17-31. https://doi.org/10.1159/000093348

[29] El-Marakby, A.M., Al-Sabri, F.A., Alharbi, S.A., Halawani, S.M. and Yousef, M.T. (2017) Noncarious Cervical Lesions as Abfraction: Etiology, Diagnosis, and Treatment Modalities of Lesions: A Review Article. *Dentistry*, **7**, Article ID: 1000438. https://doi.org/10.4172/2161-1122.1000438