Tooth Wear Lesions: Prevalence and Associated Risk Factors Among Patients Attending the Dental Clinic of a Tertiary Hospital in Ondo State, Nigeria

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***Key words**:* Tooth wear lesion, Risk factors, Attrition, Abrasion, Erosion

ABSTRACT

Objective

To determine the prevalence of tooth wear lesions and assess associated risk factors among patients attending the dental clinic of a state tertiary teaching hospital in Nigeria.

Background

This cross-sectional study was conducted over a three-month period among randomly selected patients attending the outpatient dental clinic of the University of Medical Sciences Teaching Hospital. Data were collected using a structured questionnaire to obtain socio-demographic information, lifestyle factors, oral habits, and oral hygiene practices potentially associated with tooth wear. Clinical examination for tooth wear was performed using the Smith and Knight Tooth Wear Index. Data were analyzed using SPSS version 25, with statistical significance set at $p < 0.05$.

Results

A total of 102 participants aged 16 years and above were included, comprising 55 males (53.9%) and 47 females (46.1%). The overall prevalence of tooth wear was 56.9%. Among the 9,792 examined surfaces, 61.3% showed signs of wear, while 36.9% of participants exhibited pathological wear. Erosion was the most prevalent type (28.5%), followed by attrition (15.8%) and abrasion (12.4%). Multiple lesion types were observed in 8.8% of participants. Males had more worn surfaces (56.6%) than females (43.4%), though the difference was not statistically significant ($p = 0.928$). Tooth wear was significantly associated with age ($p < 0.01$), with the highest prevalence in individuals aged 40–49 years (18.7%) and those aged 50 and above (20.8%). Pathological wear was also most common in these age groups. Nail biting showed a strong association with tooth wear ($p < 0.01$), while bruxism demonstrated borderline significance ($p = 0.05$). Dietary factors, including daily consumption of fruit juice ($p = 0.015$) and soft or energy drinks ($p = 0.021$), were significantly associated with tooth wear, highlighting dietary acids as key contributors.

Conclusion

Tooth wear is highly prevalent, particularly among adults over 40 years of age, with erosion being the most common type. Age, nail biting, and frequent fruit juice consumption were the most significant predictors. These findings emphasize the need for early risk assessment, patient education, and behavioural interventions to prevent the progression and long-term effects of tooth wear.

INTRODUCTION

Tooth wear (TW), also known as tooth surface loss (TSL), is a multifactorial process characterized by the progressive loss of enamel and dentin. This condition significantly impacts tooth survival and oral health-related quality of life.[1] TW is non-carious and occurs due to attrition, erosion, or abrasion, either individually or in combination.[2] These processes can be broadly categorized into mechanical wear (abrasion and attrition) and chemical wear (erosion).[3] Physiological tooth wear is a normal aging process, typically characterized by an annual vertical enamel loss of approximately 0.02–0.04 mm.[4] The most commonly affected teeth are the upper incisors and lower first molars, with wear patterns often bilateral and symmetrical.[3] As advances in dental care have extended the lifespan of natural dentition, tooth wear has become more apparent over time.[5] Contributing factors include muscular forces, dietary habits, salivary flow, and restorative material selection, with the latter being primarily under the dentist's control.[6]

The main forms of TW include attrition, erosion, abrasion, and abfraction. Attrition is a physiologic form of tooth-to-tooth contact wear, which primarily affects occlusal and incisal surfaces but can also occur interproximally due to lateral movement of teeth.[7] It is characterized by small polished facets on cusps and ridges, flattening of incisal edges, reduced cusp height, broader interproximal spaces, flattened occlusal inclined planes, and dentin exposure.[8] Common causes of attrition include bruxism and malocclusion, with risk factors such as enamel defects (e.g., fluorosis, enamel hypoplasia, dentinogenesis

imperfecta), premature occlusal contacts, and edge-to-edge occlusion.[8] Erosion occurs when teeth are exposed to acidic substances from internal sources (e.g., gastroesophageal reflux disease [GERD], chronic vomiting) or external sources (e.g., acidic foods and drinks, industrial fumes). Soft drinks, in particular, contain acids with calcium-chelating properties that inhibit enamel remineralization.[9] Frequent consumption of acidic drinks and habits such as swishing them in the mouth can exacerbate erosion, leading to dentin hypersensitivity and increased susceptibility to tooth fractures.[10] Abrasion results from mechanical forces involving foreign objects or substances. Common causes include chewing hard substances like bones, improper brushing techniques, hard-bristled toothbrushes, abrasive toothpaste, and habits such as nail-biting, pen-chewing, nut-cracking, tobacco-chewing, and improper use of dental floss.[11,12] Abrasion is frequently associated with cervical wear, particularly when horizontal brushing strokes and excessive force are used.

Abfraction refers to the pathological loss of tooth tissue due to biomechanical forces that concentrate stress at distant sites, such as the cervical fulcrum. This localized stress leads to the flexure and fracture of enamel and dentin.[13] Factors such as malocclusion and bruxism contribute to this type of localized flexural damage.[14] Tooth wear is influenced by a wide range of factors, including oral habits, dental conditions, dietary patterns, and systemic conditions.[15] While physiological tooth wear is generally slow and age-related, pathological wear often progresses more rapidly.[16] Severe tooth wear can impair oral function and significantly affect quality of life. In extreme cases, it may lead to difficulties with chewing, malnutrition, and an increased risk of hospitalization.

Indices such as the Tooth Wear Index (TWI) and the Basic Erosive Wear Examination (BEWE) have been developed to evaluate and monitor TW. The TWI, introduced by Smith and Knight in 1984,[17] remains the most widely used tool for assessing the aetiology, progression, and epidemiology of tooth wear. It was the first comprehensive index designed to measure and monitor multifactorial tooth wear. The TWI evaluates the four surfaces of a tooth based on enamel loss, dentin exposure, and contour changes.[17] While tooth wear has been extensively studied in developed countries, limited research exists on its prevalence, causes, and clinical features in Ondo State, Nigeria. This study aims to fill these gaps by examining the prevalence and associated risk factors influencing tooth wear among patients attending the University of Medical Sciences Dental Clinic, Ondo. The findings of this study are expected to inform preventive strategies and contribute to a more comprehensive understanding and management of tooth wear in Nigeria.

METHODS

Study Design and Setting

This descriptive cross-sectional study was conducted among patients attending the Dental Clinic of the University of Medical Sciences Teaching Hospital (UNIMEDTH), Ondo State, Nigeria. Ethical approval was obtained from the Ethics and Research Committee of the University of Medical Sciences, Ondo (NHREC/TR/UNIMED-HREC-Ondo St/22/06/21). Written informed consent was obtained from all participants, ensuring confidentiality and adherence to ethical standards.

Sample Size and Participant Recruitment

A sample size of 102 participants was determined using Leslie Kish's formula.[18] New patients aged 16 years and above attending the outpatient dental clinic over a three-month period were recruited consecutively. Inclusion criteria included age ≥16 years and having at least 20 natural teeth. Patients with fewer than 20 teeth or with restorations covering the entire surfaces of incisors, canines, premolars, or molars were excluded.

Sample Size Justification / Power Analysis

A post hoc power analysis was conducted to assess the adequacy of the sample size. Using a chi-square test to detect associations between categorical variables (e.g., risk factors and the presence of tooth wear lesions), and assuming a medium effect size (Cohen's $w = 0.30$), an alpha level of 0.05, and a power of 0.80, the minimum required sample size was estimated at 88 participants. With 102 participants recruited, the sample size exceeded the minimum requirement, ensuring sufficient power to detect statistically meaningful associations.

Data Collection Instruments and Procedures

Data collection involved two key instruments:

1. **A standardized, structured questionnaire**, adapted from a previous study,20 administered in English to obtain:
    - Sociodemographic data (e.g., gender, date of birth)
    - Oral habits and potential risk factors for tooth wear, including tooth brushing frequency and technique, toothbrush type, and frequency of consumption of citrus fruits, citrus-flavoued sweets/gums, fruit juices, sports drinks, and soft drinks.
2. **The Smith and Knight Tooth Wear Index (TWI)** for clinical assessment of tooth wear.

Tooth Wear Assessment

A comprehensive dental examination was conducted on well-illuminated dental chairs by three calibrated dental professionals. Initial screening was done using wooden spatulas, followed by detailed examination using gloves, dental mirrors, and probes.

Six teeth per quadrant were examined (totalling 12 per jaw and 24 teeth per patient. For each tooth, four surfaces—buccal, cervical, lingual/palatal, and occlusal/incisal—were examined. Teeth were dried with an air syringe, and wear was assessed visually using a dental mirror and probe.

Tooth wear types were identified following guidelines by Kelleher and Bishop[21]:

- **Attrition**: evaluated on occlusal and incisal surfaces
- **Abrasion**: assessed at the cemento-enamel junction
- **Erosion**: observed on labial, buccal, palatal, and lingual surfaces

Each surface was scored according to the Smith and Knight TWI.[17]

Examiner Calibration and Reliability Testing

Examiners underwent a one-day training session on the TWI and diagnostic criteria for attrition, abrasion, and erosion. Inter-examiner reliability was assessed using the unweighted kappa statistic, yielding a strong agreement ($\kappa = 0.82$). Intra-examiner reliability scores were 0.88, 0.86, and 0.84 for the three examiners, indicating substantial agreement according to Landis and Koch's classification.

Pre-Test and Instrument Validation

The questionnaire was pre-tested among 15 patients who were not part of the main study but shared similar characteristics with the target population. Feedback on clarity and comprehension was used to refine the instrument. Internal consistency was confirmed with a Cronbach's alpha of 0.71, indicating good reliability.

Data Analysis

Data were analyzed using IBM SPSS Statistics for Windows, Version 25.0 (Armonk, NY, USA). Descriptive statistics (frequencies, percentages, tables, and pie charts) summarized the socio-demographic and clinical variables. Bivariate and multivariate analyses were conducted to explore associations between independent variables and tooth wear. A p-value < 0.05 was considered statistically significant. In this study, tooth wear scores of 1 and 2 were classified as non-pathological, while scores of 3 and 4—indicating more severe forms of tooth wear—were considered pathological.[17](Table 1)

Table 1: *Smith and Knight's tooth wear index (TWI)* [17]

SCORE	SURFACE	CRITERIA
0	Buccal/lingual/palatal/occlusal/incisal	No loss of enamel surface characteristics
	Cervical	No loss of contour
1	Buccal/lingual/palatal/occlusal/incisal	Loss of enamel surface characteristics
	Cervical	Minimal loss of contour
2	Buccal/lingual/palatal/occlusal/	Loss of enamel exposing dentine for less than one third of surface
	Incisal	Loss of enamel that minimally exposes dentin
	Cervical	Defect <1 mm deep
3	Buccal/lingual/palatal/occlusal/	Loss of enamel exposing dentine for more than one third of the surface
	Incisal	Loss of enamel and substantial loss of dentin
	Cervical	Defect <1-2 mm deep
4	Buccal/lingual/palatal/occlusal/	Complete enamel loss, pulp exposure, secondary dentine exposure
	Incisal	Pulp exposure or exposure of secondary dentine
	Cervical	Defect >2 mm deep pulp exposure, secondary dentine exposure

Males constituted a slightly higher proportion of the study population, with 52 respondents (52.9%). The largest age group was 30–39 years, comprising 27 participants (26.5%), followed closely by the 16–29 age group with 26 participants (25.5%). The smallest age group was those aged 50 years and above, with 24 respondents (23.5%). Regarding educational attainment, the majority of participants had university-level education (55, 53.9%), while a smaller proportion had only primary education (12, 11.8%). In terms of occupation, artisans formed the largest group, accounting for 48 participants (47.1%), followed by employees and farmers, each representing 24 participants (23.5%). The socio-demographic characteristics of the participants are illustrated in Figure 1

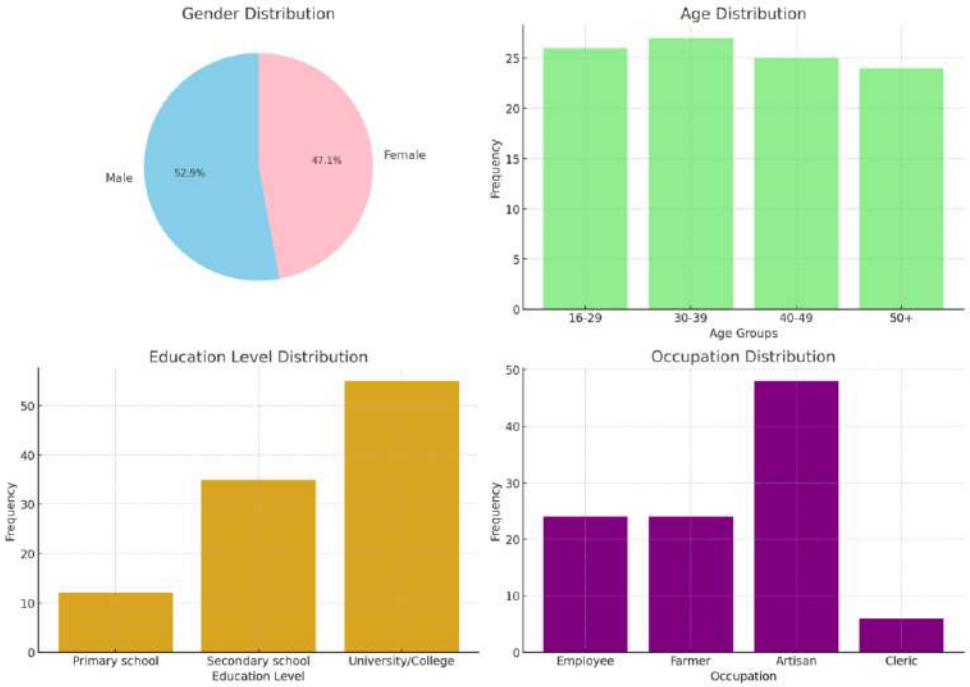


Figure 1: Socio-demographic Characteristics of Respondents

The Tooth Wear Index (TWI) scoring system (0–4) was used to assess wear or damage on the buccal, labial, occlusal/incisal, and cervical surfaces of anterior teeth and first molars in both the maxillary and mandibular arches. Each score reflects the severity of tooth wear, with distinct patterns observed in the distribution of wear across these surfaces. (Tables 2 and 3)

Table 2: *Clinical Examination- maxilla*

Tooth surfaces/TWI scores		Central Incisor (%)	Lateral Incisor (%)	Canine (%)	First premolar (%)	Second premolar (%)	First molar (%)
Buccal	0	19 (18.6)	45 (44.1)	39 (38.2)	59 (57.8)	64 (62.7)	48 (47.0)
	1	67 (65.7)	27 (26.5)	26 (25.5)	16 (15.7)	24 (23.5)	22 (21.6)
	2	11 (10.8)	22 (21.6)	23 (22.5)	5 (4.9)	13 (12.8)	22 (21.6)
	3	3 (2.9)	4 (3.9)	12 (11.8)	22 (21.6)	1 (1.0)	7 (6.9)
	4	2 (2.0)	4 (3.9)	2 (2.0)	0 (0.0)	0 (0.0)	3 (2.9)
Total		100.0	100.0	100.0	100.0	100.0	100.0
Lingual	0	31 (30.3)	29 (28.4)	24 (23.5)	50 (49.0)	58 (56.9)	41 (40.2)
	1	58 (56.9)	33 (32.4)	42 (41.2)	18 (17.6)	17 (16.7)	26 (25.5)
	2	7 (6.9)	21 (20.6)	18 (17.6)	27 (26.5)	22 (21.5)	28 (27.4)
	3	4 (3.9)	11 (10.8)	16 (15.7)	5 (4.9)	3 (2.9)	6 (5.9)
	4	2 (2.0)	8 (7.8)	2 (2.0)	2 (2.0)	2 (2.0)	1 (1.0)
Total		100.0	100.0	100.0	100.0	100.0	100.0
Occlusal/Incisal	0	9 (8.8)	42 (41.2)	18 (17.7)	44 (43.2)	53 (52.0)	44 (43.2)
	1	33 (32.4)	37 (36.2)	24 (23.5)	24 (23.5)	24 (23.5)	22 (21.5)
	2	23 (22.5)	15 (14.7)	20 (19.6)	20 (19.6)	26 (25.5)	23 (22.5)
	3	28 (27.5)	6 (5.9)	20 (19.6)	6 (5.9)	9 (8.8)	7 (6.9)
	4	8 (7.8)	2 (2.0)	20 (19.6)	8 (7.8)	0 (0.0)	6 (5.9)
Total		100.0	100.0	100.0	100.0	100.0	100.0
Cervical	0	64 (62.8)	48 (47.0)	23 (22.5)	46 (45.1)	59 (57..8)	58 (56.9)
	1	13 (12.7)	32 (31.4)	42 (41.2)	23 (22.5)	22 (21.6)	16 (15.7)
	2	20 (19.6)	6 (5.9)	1 (1.0)	20 (19.6)	11 (10.8)	9 (8.8)
	3	5 (4.9)	9 (8.8)	15 (14.7)	12 (11.8)	9 (8.8)	17 (16.6)
	4	0	7 (6.9)	20 (19.6)	1 (1.0)	1 (1.0)	2 (2.0)
Total		100.0	100.0	100.0	100.0	100.0	100.0

Table 3: *Clinical Examination- mandible*

Tooth surfaces/TWI scores		Central Incisor (n=102) (%)	Lateral Incisor (n=102) (%)	Canine (n=102) (%)	First premolar (n=102) (%)	Second premolar (n=102) (%)	First molar (n=102) (%)
Buccal	0	15 (14.7%)	25 (24.5%)	25 (24.5%)	53 (52.0%)	58 (56.9%)	54 (52.9%)
	1	70 (68.6%)	52 (51.0%)	24 (23.5%)	19 (18.6%)	22 (21.6%)	21 (20.6%)
	2	12 (11.8%)	11 (10.8%)	19 (18.6%)	17 (16.7%)	21 (20.6%)	16 (15.7%)
	3	3 (2.9%)	9 (8.8%)	18 (17.6%)	9 (8.8%)	1 (1.0%)	8 (7.8%)
	4	2 (2.0%)	5 (4.9%)	16 (15.7%)	4 (3.9%)	0 (0.0%)	3 (2.9%)
Total		100.0	100.0	100.0	100.0	100.0	100.0
Lingual	0	34 (33.3%)	57 (55.9%)	62 (60.8%)	58 (56.9%)	53 (52.0%)	57 (55.9%)
	1	56 (54.9%)	24 (23.5%)	19 (18.6%)	20 (19.6%)	20 (19.6%)	20 (19.6%)
	2	7 (6.9%)	7 (6.9%)	18 (17.6%)	17 (16.7%)	23 (22.5%)	23 (22.5%)
	3	4 (3.9%)	6 (5.9%)	2 (2.0%)	5 (4.9%)	5 (4.9%)	2 (2.0%)
	4	1 (1.0%)	8 (7.8%)	1 (1.0%)	2 (2.0%)	1 (1.0%)	0 (0.0%)
Total		100.0	100.0	100.0	100.0	100.0	100.0
Occlusal/Incisal	0	8 (7.8%)	59 (57.8%)	61 (59.8%)	61 (59.8%)	57 (55.9%)	12 (11.8%)
	1	31 (30.4%)	19 (18.6%)	15 (14.7%)	19 (18.6%)	20 (19.6%)	57 (55.9%)
	2	24 (23.5%)	9 (8.8%)	14 (13.7%)	17 (16.7%)	22 (21.6%)	16 (15.7%)
	3	34 (33.3%)	9 (8.8%)	9 (8.8%)	4 (3.9%)	2 (2.0%)	9 (8.8%)
	4	5 (4.9%)	6 (5.9%)	3 (2.9%)	1 (1.0%)	1 (1.0%)	8 (7.8%)
Total		100.0	100.0	100.0	100.0	100.0	100.0
Cervical	0	56 (54.9%)	58 (56.9%)	50 (49.0%)	41 (40.2%)	45 (44.1%)	57 (55.9%)
	1	21 (20.6%)	24 (23.5%)	19 (18.6%)	21 (20.6%)	31 (30.4%)	26 (25.5%)
	2	18 (17.6%)	8 (7.8%)	17 (16.7%)	25 (24.5%)	16 (15.7%)	7 (6.9%)
	3	7 (6.9%)	5 (4.9%)	15 (14.7%)	9 (8.8%)	7 (6.9%)	3 (2.9%)
	4	0 (0.0%)	7 (6.9%)	1 (1.0%)	6 (5.9%)	3 (2.9%)	9 (8.8%)
Total		100.0	100.0	100.0	100.0	100.0	100.0

Out of the 102 participants, 58 (56.9%) exhibited at least one form of tooth wear, with males accounting for the majority (58.6%). Among those affected, 15.8% had attrition only, 12.4% presented with abrasion only, 28.5% experienced erosion only, and 8.8% displayed multiple types of tooth wear lesions. In total, 9,792 tooth surfaces were examined, of which 6,000 (61.3%) showed evidence of wear. Of these worn surfaces, 3,388 (56.5%) were found in male participants. (Table 4)

Table 4: *Distribution of tooth wear type and worn surfaces by gender*

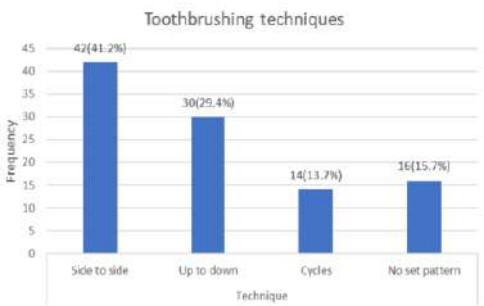
Tooth wear type	Total No. of patients	Total No. of patients by Sex		Worn surfaces Frequency (%)	Worn surfaces by Sex	
		Male	**Female**		**Male frequency**	**Female frequency**
Abrasion	11 (12.4%)	7	4	1216 (12.4)	774	442
Erosion	26 (28.5%)	11	15	2780 (28.4)	1177	1603
Attrition	12 (15.8%)	8	4	1548 (15.8)	1032	516
Combined (Abrasion, Attrition and/or Erosion)	9 (8.8%)	8	1	456 (4.7)	405	51
Total	58 (56.9%)	34 (58.6%)	24 (41.4%)	6000 (61.3)	3388	2612

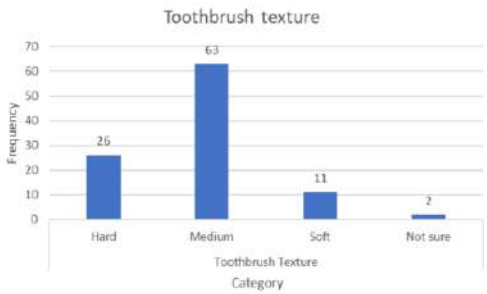
Of the 6,000 worn surfaces identified, 2,391 (39.9%) were classified as non-pathological, while 3,609 (60.1%) exhibited pathological wear. Pathological tooth wear was most prevalent in the 40–49 and 50+ age groups, which also had the highest overall wear, highlighting the greater burden of both pathological and non-pathological tooth wear among older individuals. The percentages reported below are based on the total number of examined surfaces (9,792). Total worn surfaces accounted for 6,000 (61.3%), with 3,609 (36.9%) representing pathologically worn surfaces. (Table 5)

Table 5: *Frequency distribution of pathological and non-pathological worn surfaces by age group using TWI*

Age group	No of patients	Non-pathologic worn surfaces	Pathologic worn surfaces
n	n %	n %	n %
16-29	26 (25.5)	400 (6.7)	371 (6.2)
30-39	27 (26.5)	618 (10.3)	867 (14.5)
40-49	25 (24.5)	721 (12.0)	1121 (18.7)
>50	24 (23.5)	652 (10.9)	1250 (20.8)
Total	102 (100.0)	2391 (39.9)	3609 (60.1)

The most commonly reported tooth-brushing technique was horizontal (side-to-side) brushing, used by 41.2% of participants. Other techniques included vertical (up-and-down) brushing (29.4%), circular motions (13.7%), and brushing with no specific pattern (15.7%). The majority of respondents (63; 61.8%) used medium-textured toothbrushes, followed by hard (26; 25.5%) and soft (11; 10.8%) varieties. A small fraction (1.9%) was unsure of their toothbrush texture. Most participants (70.5%) reported brushing once daily, while 24.5% brushed twice daily and only 4.9% brushed more than twice daily. A significant proportion (73.5%) rarely or never brushed immediately after consuming acidic foods, a behavior that may contribute to dental erosion. Additionally, 22.5% used charcoal-infused toothbrushes, perceived to offer added oral health benefits. Only a small number (6.9%) reported using alternative abrasive substances such as ground glass or stone. (Figure 2a)





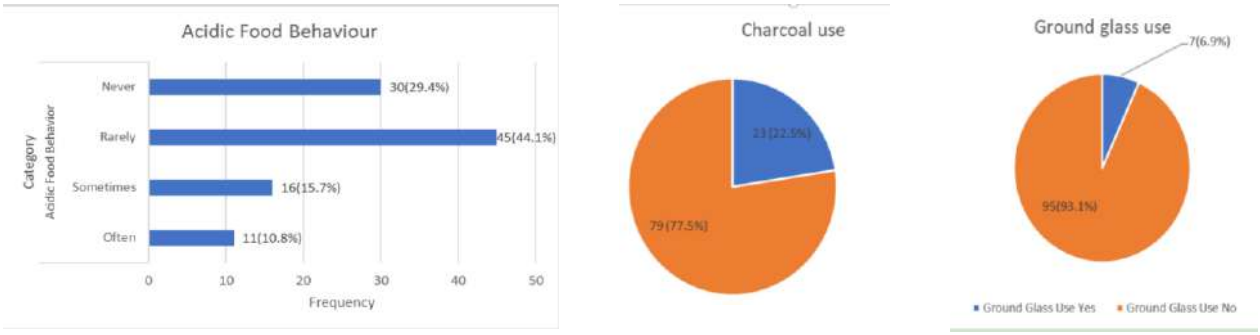


Figure 2a:

A notable proportion of participants reported engaging in nail biting (13.7%) and teeth grinding during the day or night (26.5%), while 30.4% experienced clenching or grinding their teeth at rest. Regarding symptoms associated with acid reflux, the majority of respondents reported no or mild heartburn, typically occurring after meals (91.2%). Vomiting symptoms were experienced to varying degrees, ranging from mild to severe, by 32.4% of participants. (Figure 2b)

Citrus fruits are commonly consumed, with 41.2% of participants eating them weekly and 23.5% daily, posing a risk for enamel erosion due to their acidity. Daily intake of soft and energy drinks is reported by 36.3%, with 23.5% consuming them weekly. Similarly, fruit juice consumption is significant, with 34.3% drinking it weekly and 20.5% daily. Notably, 49.0% report daily intake of citrus-flavored gum and candy. Alcohol consumption is less frequent, with 59.8% abstaining, 17.6% consuming it monthly, and smaller proportions consuming it more frequently. Acidic medications such as aspirin and vitamin C are also commonly used, with 38.2% taking them weekly and 2.9% daily. A significant association was observed between fruit juice consumption and tooth wear. (Table 6) .

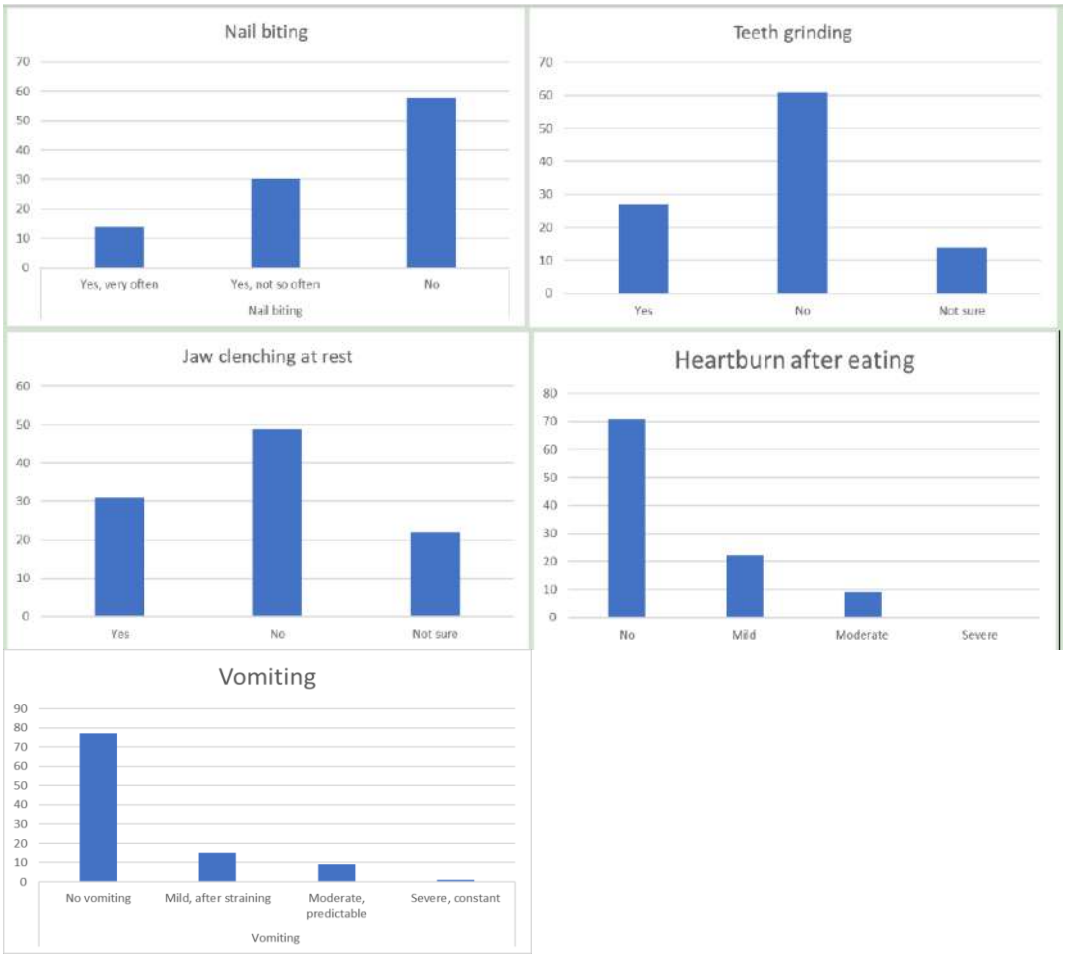


Figure 2b: Risk factors and tooth wear - Parafunctional habits and acid reflux

Table 6: *Consumption of potentially erosive foods and drinks*

Variables	Never (%)	Once per month(%)	Once per week(%)	Once per day(%)	2-3 times per day(%)	>3 times per day(%)	P value
Citrus fruits (apple, orange, lemon., etc)	6 (5.9.0)	22 (21.5)	42 (41.2)	24 (23.5)	8 (7.8)	0 (0.0)	0.091
Soft /energy drinks	10 (9.8)	20 (19.6)	24 (23.5)	37 (36.3)	9 (8.8)	2 (1.9)	0.204
Fruit juice	11 (10.8)	31 (30.4)	35 (34.3)	21 (20.5)	4 (3.9)	0 (0.0)	0.021*
Citrus gum/candy	50 (49.0)	18 (17.6)	11 (10.8)	14 (13.7)	8 (7.8)	1 (1.1)	0.071
Alcohol	61 (59.8)	18 (17.6)	8 (7.8)	7 (6.9)	7 (6.9)	1 (1.1)	0.360
Medication (aspirin, vitamin C)	45 (44.1)	39 (38.2)	14 (13.7)	3 (2.9)	1 (1.1)	0 (0.0)	0.091

A multivariate logistic regression analysis was conducted to determine the independent association between sociodemographic factors and the presence of tooth wear lesions. The model included gender, age group, and education level as predictor variables. After adjusting for potential confounders, age remained significantly associated with the presence of tooth wear.

Participants aged 40–49 years had 5.6 times higher odds of having tooth wear lesions compared to those aged 16–29 years (OR = 5.40), with 95% certainty that the true effect lies between 1.56 and 20.55 ($p < 0.01$). Similarly, those aged 50 years and above had 4.59 times higher odds of tooth wear (OR = 4.59), with a 95% confidence interval ranging from 1.28 to 16.40 ($p = 0.019$). These results indicate a significant and independent effect of older age on the likelihood of developing tooth wear. In contrast, neither gender nor education level was significantly associated with tooth wear in the adjusted model. These findings suggest that age is the most consistent and significant predictor of tooth wear among the factors studied, with older adults being considerably more at risk. (Table 7)

Table 7: *Multivariate analysis showing the Relationship between socio-demographic characteristics and tooth wear*

Variables		**Presence of Tooth Wear**		Total		95% CI		P value
		No	Yes		AOR	Lower	Upper	
Gender	Male	23	32	55	-	-	-	
	Female	21	26	47	1.042	0.430	2.524	0.928
	Total	44	58	102				
Age	16-29	14	10	24	-	-	-	
	30-39	19	10	29	0.737	0.233	2.324	0.602
	40-49	5	20	25	5.658	1.558	20.549	**0.008***
	50+	6	18	24	4.590	1.284	16.406	**0.019***
	Total	44	58	102				
Education Level	Primary school	7	4	11	-	-	-	-
	Secondary school	14	22	36	2.957	0.629	13.897	0.170
	University/College	23	32	55	1.945	0.440	8.595	0.380
	Total	44	58	102				

* Statistically significant ($p < 0.05$)

Nail biting ($p < 0.01$) and teeth clenching or grinding at rest ($p = 0.034$) were significantly associated with tooth wear, indicating that these parafunctional habits contribute to enamel damage. A borderline p-value (e.g., 0.061 for teeth grinding) suggests that this may be a trend worth further investigation, but it is not strong enough to conclude a significant relationship. This indicates the potential need for a larger sample size or further study to determine whether these variables may have a subtle, yet important, effect on tooth wear. (Table 8)

Table 8: *Association between attritive and abrasive risk factors for tooth wear and drinks and tooth wear*

Variables		Presence of Tooth Wear No	Yes	Total	P value
Tooth brushing and Abrasive use					
Tooth brushing frequency	Once daily	31	42	73	0.550
	Twice daily	10	15	25	
	More than twice daily	3	1	4	
	Total	44	58	102	
Technique of brushing	Horizontal (Side to side)	18	25	43	0.918
	Vertical (Up to down)	12	18	30	
	Cycles	6	7	13	
	Total	44	58	102	
I Brush right after taking acidic food	Often	5	4	9	0.184
	Sometimes	8	8	16	
	Rarely	23	24	47	
	Never	8	22	30	
	Total	44	58	102	
Tooth brush texture	Hard	11	16	27	0.669
	Medium	28	36	64	
	Soft	5	6	11	
	Total	44	58	102	
The use of charcoal with toothbrush	Yes	7	16	23	0.134
	No	37	42	79	
	Total	44	58	102	
Use of ground glass or stone to brush	Yes	1	5	6	0.376
	No	43	53	96	
	Total	44	58	102	
Parafunctional activity/habit					
Nail biting	Yes	10	34	44	**<.01***
	No	34	24	58	
	Total	44	58	102	44
Do you often grind your teeth during the day or at night	Yes	7	21	28	0.061
	No	32	30	62	
	Not sure	5	7	12	
	Total	44	58	102	
Do you clench/grind your teeth when at rest	Yes	8	23	31	**0.034***
	No	28	23	51	
	Not sure	8	12	20	
	Total	44	58	102	
Acid reflux					
Heartburn usually after eating	No heart burn	32	41	73	0.971
	Mild	9	13	22	
	Moderate	3	4	7	
	Total	44	58	102	
Vomiting	No vomiting	34	44	78	0.687
	Mild, after straining	5	8	13	
	Moderate, predictable	4	6	10	
	Severe, constant	1	0	1	
	Total	44	58	102	

* Statistically significant ($p < 0.05$)

A multivariate logistic regression analysis was conducted to identify independent predictors of tooth wear among adult dental patients. After adjusting for potential confounding variables, **age** emerged as a significant predictor. Individuals aged 40–49 years had significantly higher odds of experiencing tooth wear compared to those aged 16–29 years (adjusted odds ratio [AOR] = 13.35; 95% confidence interval [CI]: 2.33–76.48; p = 0.004), while those aged 50 years and above had similarly elevated odds (AOR = 13.17; 95% CI: 1.98–87.41; p = 0.008).

Soft/energy drink consumption was also significantly associated with tooth wear. Participants who consumed soft drinks once per month had 11.48 times higher odds of experiencing tooth wear (AOR = 11.48; 95% CI: 1.36–96.69; p = 0.025), and those consuming them daily had 12.47 times higher odds (AOR = 12.47; 95% CI: 1.46–106.26; p = 0.021). However, the association did not follow a linear trend across all consumption frequencies.

Fruit juice consumption demonstrated an even stronger association. Daily intake was associated with a markedly increased likelihood of tooth wear (AOR = 21.29; 95% CI: 1.60–282.99; p = 0.021). Weekly consumption also showed a potential association, though it did not reach statistical significance (AOR = 10.50; 95% CI: 0.90–122.13; p = 0.060).

Parafunctional habits, particularly bruxism (defined as clenching or grinding of teeth at rest), were borderline significantly associated with tooth wear (AOR = 5.68; 95% CI: 0.999–32.25; p = 0.050).

Other variables, including toothbrushing technique, toothbrush texture, and frequency of brushing, were not significantly associated with tooth wear. Nonetheless, the wide confidence intervals observed for several predictors suggest variability, possibly due to small subgroup sizes. Despite this limitation, the strong effect sizes observed for age and dietary habits underscore their potential clinical importance and suggest the need for further investigation. (Table 9)

Table 9: *Multivariate analysis showing the Relationship between age, oral habits, diet, toothbrushing and tooth wear*

Variables			**95% CI**		P value		95% CI		P value
		Unadjusted Odds Ratio	Lower	Upper		Adjusted Odds Ratio (AOR)	Lower	Upper	
Age	16-29	-	-	-	-	-	-	-	
	30-39	0.737	0.241	2.249	0.592	0.826	0.180	3.795	0.806
	40-49	5.600	1.569	19.989	0.008*	13.346	2.329	76.477	**0.004***
	50+	4.200	1.228	14.365	0.022*	13.168	1.984	87.409	0.008*
Soft/energy drinks consumption	Never	-	-	-	-	-	-	-	-
	Once per month	2.333	0.488	11.167	0.289	11.480	1.363	96.692	**0.025***
	Once per week	0.857	0.199	3.690	0.836	2.965	.435	20.215	0.267
	Once per day	1.643	0.403	6.705	0.489	12.471	1.464	106.257	**0.021***
	2-3 times per day	0.750	0.107	5.238	0.772	2.493	0.190	32.696	0.487
	>3 times per day	1.000	0.048	20.829	1.000	3.615	0.061	215.745	0.538
Fruit juice consumption	Never	-	-	-	-	-	-	-	-
	Once per month	2.265	0.396	12.966	0.359	2.340	0.180	30.444	0.516

	Once per week	7.955	1.419	44.603	**0.018***	10.503	0.903	122.126	0.060
	Once per day	8.312	1.408	49.063	**0.019***	21.291	1.602	282.990	**0.021***
	2-3 times per day	3.500	0.145	84.694	0.441	.369	.008	16.820	0.609
Do you clench/grind your teeth when at rest	Yes	1.917	0.575	6.383	0.289	5.676	0.999	32.246	**0.050***
	No	0.548	0.191	1.566	0.261	1.290	0.271	6.146	0.749
	Not sure	-	-	-	-	-	-	-	-
Technique of brushing	Horizontal (Side to side)	1.389	0.439	4.396	0.576	3.091	0.508	18.796	0.221
	Vertical (Up to down)	1.500	0.442	5.092	0.516	4.695	.756	29.174	0.097
	Cycles	1.167	0.269	5.054	0.837	2.304	0.265	20.017	0.449
	No Set Pattern	-	-	-	-	-	-	-	-
Tooth brush texture	Hard	1.212	0.295	4.982	0.790	0.284	0.033	2.432	0.251
	Medium	1.071	0.296	3.875	0.916	0.333	0.058	1.915	0.218
	Soft	-	-	-	-	-	-	-	-

* Statistically significant (p <0.05)

DISCUSSION

Findings

This study assessed the prevalence and risk factors associated with tooth wear among patients attending a state tertiary hospital in Nigeria. Regarding gender, males exhibited 56.6% of worn surfaces, significantly higher than females (43.4%). This finding is consistent with studies in Nigeria,[5,24] the Northwest United States,[25] and the United Kingdom,[26] which reported higher tooth wear prevalence in males. Potential explanations include greater parafunctional habits (e.g., bruxism, nail biting) and occupational exposure to abrasive materials. Age-related differences were observed, with participants aged 40–49 and 50+ showing the highest pathological wear prevalence (18.7% and 20.8%, respectively). This supports previous findings in Lagos[24] and Igbo-Ora in Oyo State[27], where older individuals were 10 times more likely to exhibit tooth wear than younger counterparts.[20] The cumulative effects of dietary acids, bruxism, and mechanical wear over time likely explain this trend, underscoring the need for early dietary advice among children and adults before erosion develops.

The overall prevalence of tooth wear in this study was 56.9%, with 61.3% of the 9,792 examined surfaces exhibiting signs of wear. This finding is similar to the 53%, 55.3%, and 58.6% reported in Igbo-ora,[28] Benin City,[19] and Ibadan,[29] respectively, but contrasts with the 40.4% reported by Alade and Orikpete[30] among patients in Port Harcourt. In addition, the prevalence of pathological wear in this study was 36.9%, which is higher than previous findings of 4.5% and 6.5% reported by Smith and Knight[17],

and Oginni and Olushile,[5] respectively. Differences in study design and environmental factors (e.g., diet, oral hygiene) may contribute to this variability. Erosion was the most prevalent form of tooth wear (28.5% of worn surfaces), followed by attrition (15.8%) and abrasion (12.4%). This is similar to findings in Saudi Arabia[31] and among the European population,[32] but differs from earlier Nigerian studies[5,19,28,30] where attrition was the dominant form. This discrepancy suggests either changes in risk factor exposure (e.g., increased consumption of acidic foods/drinks) due to the gradual westernization of the Nigerian lifestyle or methodological differences between studies.[5] Previous studies have noted the frequent co-existence of multiple tooth wear lesions on the same tooth.[5,19,29] In this study, 8.8% of participants presented with multiple types of tooth wear lesions.

Oral examination revealed that 12.4% of participants had abrasion, likely due to incorrect brushing techniques. 41.2% of participants used a horizontal (side-to-side) brushing technique, and 25.5% used hard-textured toothbrushes. However, no statistically significant association was found between brushing technique and tooth wear ($p = 0.918$), suggesting that other factors like toothpaste abrasiveness, brushing force, and frequency may be more significant in tooth wear. Dietary factors were also analyzed: 41.2% of participants consumed citrus fruits weekly, while 36.3% consumed soft/energy drinks daily. While soft drink consumption was not significantly ($p = 0.204$) linked to tooth wear, multivariate regression revealed that monthly (AOR = 11.48, $p = 0.025$) and daily (AOR = 12.47, $p = 0.021$) consumption were independently associated with increased odds of tooth wear. Fruit juice consumption was more consistently associated with wear. Those who consumed fruit juice daily had nearly 21.29 times greater odds of developing tooth wear (AOR = 21.29, $p = 0.021$). Weekly fruit juice intake showed borderline significance (AOR = 10.50, $p = 0.060$). Our findings agree with studies suggesting that fruit juices have lower pH and higher enamel erosion potential than soft drinks due to citric acid chelation effects.[9] Additionally, medications such as aspirin and vitamin C, which are regularly consumed by 38.2% of respondents, are known to cause demineralization of teeth due to their low pH.[23] However, this study did not establish a significant association between aspirin use and erosion, which contrasts with findings by Wei Z et al. (2016),[33] who reported a strong relationship.

Parafunctional habits were strongly associated with tooth wear in this study. Nail biting showed a highly significant association ($p < 0.01$), supporting previous research indicating that chronic nail biting contributes to attrition and enamel microfractures.[11] Although bruxism had a borderline significance in the adjusted model (AOR = 5.68, $p = 0.50$), the trend supports Sierpinska et al.'s (2016)[3] [4] statement that bruxism can exacerbate pathological tooth wear, a phenomenon highlighted by the 36.9% of pathologically worn surfaces observed in this study.

Implications

These results stress the need for comprehensive patient education and counselling focused on modifiable risk factors, such as acidic dietary habits and parafunctional behaviours. Clinicians should pay close attention to older adults and individuals reporting frequent fruit juice or soft drink intake or nail biting, as these groups appear to be at significantly elevated risk. Special attention should be paid to fruit juices!

Trade-offs (Limitations)

- The cross-sectional design limits the ability to infer causality between risk factors and tooth wear.
- Although logistic regression was used to control for confounding, residual confounding and recall bias may still affect associations.
- Some variables, such as bruxism and weekly fruit juice consumption, showed p-values near significance thresholds, indicating that larger sample sizes may be necessary to confirm these relationships.
- Moreover, the self-reported nature of brushing techniques and dietary intake could have introduced reporting errors.
- Despite these limitations, the study offers valuable insights into behavioural and demographic contributors to tooth wear in this population.

Take-home (Conclusion)

Our study found strong independent predictors of tooth wear to be:

- Aging: 40–49 and 50years and above had more than 13 times the odds of experiencing tooth wear compared to those aged 16–29.
- Daily fruit juice intake: 21-fold increase in risk
- Even infrequent acidic beverage consumption can be harmful- monthly soft drink intake showed significant associations
- Nail-biting remained highly significant

Expectations for Future Research

Future studies should adopt longitudinal study designs to establish causal relationships and track the progression of tooth wear over time. A more detailed examination of the dose-response relationship between dietary acids—particularly fruit juices and soft/energy drinks—and tooth wear is warranted, alongside

investigations into brushing frequency, force, and technique. The strong association observed with nail biting suggests a need to explore its underlying mechanisms and potential behavioural interventions. Borderline associations, such as bruxism and weekly consumption of fruit juice, also merit further investigation. Future studies should include dietary logs, wearable bite sensors, and pH monitoring devices—to improve the accuracy of behavioural assessments and mitigate reporting errors.

Recommendations

Based on the findings of this study:

1. A larger, multicentre approach is recommended
2. Dental professionals should routinely assess parafunctional habits and dietary behaviours during patient evaluations, especially for middle-aged and older adults.
3. Interventions should include behavioral counselling to reduce nail biting, bruxism, and dietary counselling on the risks of frequent soft drink and fruit juice consumption.
4. Oral health education should emphasize the use of vertical or circular brushing techniques, moderate bristle hardness, and low-abrasive toothpaste. Public health campaigns can integrate these messages into broader efforts to prevent non-communicable diseases, leveraging the shared behaviour al risk factor model.

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Nil

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