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ORIGINAL RESEARCH

The Prevalence of Tooth Wear in an Adult Population from the Eastern Province of Saudi Arabia

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Aim: To assess the prevalence of tooth wear in the Eastern Province of Saudi Arabia in an adult population and to identify potential contributing factors, such as sociodemographic factors.

Methods: This cross-sectional study included adults between 18 and 40 years, seeking routine dental care. A clinical examination using the tooth wear index (TWI) was performed. Each tooth was given a TWI score, followed by classifying participants according to different risk levels. This was followed by a self-administered questionnaire on demographic information and oral hygiene habits. Statistical analyses included univariate, bivariate, as well as multivariate to assess the risk of tooth wear in relation to possible risk factors. The tests used were odds ratios (ORs) with 95% confidence intervals (CIs) and p-values < 0.05 to be statistically significant.

Results: The prevalence of tooth wear and dentin exposure was 83.5% and 58.8%, respectively, with the mean affected teeth of 1.3 ± 0.6 and 0.2 ± 0.2. Both gender and education level were significantly associated with tooth wear at bivariate and multivariate levels (p < 0.05).

Conclusion: The prevalence of tooth wear among sampled adults in this study was high. There was a clear difference in rates of tooth wear for gender and education level. Early identification and prevention of tooth wear will help reduce signs and symptoms in later stages of life.

Keywords: adult population, prevalence, tooth wear, epidemiology, Saudi Arabia

Introduction

Tooth wear, defined as the irreversible loss of hard tooth structure, not being considered caries process, resorption or trauma.[1] Is an oral condition with multi-factorial etiology and can be classified into two main subcategories: mechanical and chemical wear.[1,2] One can view it as a normal phase in the tooth's aging process. In addition, tooth wear severity might indicate that the process can be viewed as pathological.[3] Problems arise when the loss of hard tissue is substantial enough to cause tooth sensitivity or aesthetic and functional problems.[4] Upper permanent incisors are the more frequently affected teeth, followed by lower first molars. Tooth wear tends to be bilateral and symmetrical in both maxillary and mandibular teeth.[5] Its management can be challenging, while early diagnosis and intervention is paramount. Moderate to high prevalence in epidemiological studies makes it a public health concern.[6–8]

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Several global studies evaluated the prevalence and degree of tooth wear, which shed light on potential risk factors, such as sociodemographic factors and hygienic habits that contribute to the progression of the condition.[9–12] In Chengdu city, China, a study about the prevalence of tooth wear in adults showed that 63% suffered from tooth wear: age and intensity of toothbrushing were among the risk factors related to tooth wear.[9] Tooth wear of 97.9% was found in a study conducted in Chile, mainly affecting the anterior teeth, with no differences found between males and females; however, a positive correlation with age was observed.[10] In another study in Holland, assessing tooth wear in adults, a prevalence of 80% was observed for moderate tooth wear: greater tooth wear was observed in older individuals, especially males vs females, and in people of lower socioeconomic status (SES).[11] In northern Saudi Arabia, an epidemiologic study found tooth wear to be 75%; risk factors contributing to tooth wear included use of dental abrasives, exposure to dust, brushing frequency/technique, and unilateral chewing.[12]

The lack of studies on the prevalence of tooth wear among adults in Saudi Arabia is a concern. Thus, it is important to assess tooth wear and measure its effect, as this will guide dental professionals in applying measures to eventually prevent it. The aim of this research was to assess the pervasiveness of tooth wear in adults and to identify potential risk factors.

Methods
Study Design
This was a descriptive cross-sectional study to estimate the prevalence of tooth wear in the Eastern Province of Saudi Arabia in an adult population and to identify potential risk factors: sociodemographic factors, oral hygiene habits, and dental visits over the past year.

Study Population
The study population was comprised of adults (18–40 years), who sought dental treatment at the College of Dentistry, Imam Abdulrahman Bin Faisal University, and at several public dental clinics that were randomly assigned by authorities the ministry of health (MOH).

Inclusion Criteria:

1. Saudi Arabian adults (ages 18–40 years).

2. Willingness to consent and comply with the study protocol.

3. In good health (as judged by the general dental practitioner), there were no clinical abnormalities or an unusual medical history.

Exclusion Criteria
1. Adults who cannot respond to the questionnaires.

2. Adults with certain medical conditions, such as hemophilia or those using anticoagulants.

3. Adults with fixed orthodontic appliances.

Study Sample
Adults residing in the Eastern Province of Saudi Arabia were sampled to participate in the survey. Based on a sample size calculation with the following criteria, there was a 5% margin of error, a 0.05 alpha level, and a 75% expected tooth wear prevalence.[9–12] An estimated 323 participants were needed for this study (http://www.stat.ubc.ca/~rollin/stats/ssize/b1.html).

The method used for this study was the quota sampling method, assessing the prevalence and associated risk factors of tooth wear in adults of the included region. A three-stage stratification was done by sex, education, and occupation. Participants in dental clinics for oral health were invited by the general dentist and asked if they wanted to participate in the study.

Ethical Approval
Prior to the study, ethical approval from the Institutional Review Board of Imam Abdulrahman bin Faisal University was granted (IRB-2020-02-200). All patients read and signed a consent form before enrollment in the study. The study was conducted in accordance with the Declaration of Helsinki.

General Dental Calibration
Four general dentists (two dentists from the college of dentistry and two dentists from the MOH) were trained for clinical examination with the Tooth Wear Index (TWI).[13] Assessment and calibrations were conducted by an experienced dentist. Each dentist, using the gold standard, examined at least 15 patients. Cohen's kappa coefficient (= 0.65) of intra-examiner reliability was achieved before launching the study.

Data Collection
Data collection began in January and completed in May 2019: the general dentists recruited patients who agreed to be enrolled in the study, based on inclusion/

exclusion criteria. Once patients consented to the study, they filled out the self-administered questionnaires, along with clinical data collected from each patient.

Questionnaires

A validated self-administered questionnaire was used for this study.[14] The questionnaire included sociodemographic information, such as age, gender, education level, and occupation. A Likert scale demonstrated the frequency of tooth-brushing each day, as well as the type of toothbrush used. In addition, they were asked whether they used fluoride toothpaste and fluoride aids, as well as the number of dental visits they had during the last year.

Clinical Examination

Study subjects were visually examined in dental chairs, with a mouth mirror and good lighting. Prior to the dental examination, teeth were cleaned and dried, using a cotton swab to remove plaque and residue. Study outcomes included tooth wear severity with or without dentin exposure. The four main surfaces of all teeth (buccal, cervical, lingual, and occlusal/incisal) were scored, according to the TWI as described by a previous study.[15] The severity of tooth wear was scored from 0 to 4 for each tooth, based on the teeth predominantly affected. Additionally, for each sextant, the most severely affected surfaces were coded; the sum of their scores, ranging from 0 to 18, was calculated and categorized into different risk levels (none = 0–2, low = 3–8, medium = 9–13, and high = 14–18) according to Bartlett et al.[16] At the study's completion, the six sextants' personal scores coincided with a maximum score.

Statistical Analysis

Data were entered in MS Excel (2010) and transferred to IBM SPSS Statistics for Windows, version 22 (IBM Corp., Armonk, NY, USA) for statistical analysis. The univariate analyses included frequencies and percentages, as well as means and standard deviation. The variables were TWI score for each tooth, risk level, and personal score for each participant. Those with a personal score ($\geq$2) were classified as being diagnosed with tooth wear. The mean tooth was assessed according to the TWI score of each tooth. In addition, chi-square test was used to compare between different levels for the study variables.

Binary logistic regression was used to assess the link between medium- and high-risk levels regarding tooth wear. This was followed by a forward stepwise multivariate logistic regression model to assess the risk of tooth wear in relation to risk factors, which were significant at the bivariate analysis level. The test statistic was odds ratios (OR), with 95% confidence intervals (CIs), while $p < 0.05$ was considered to be statistically significant.

Results

In Table 1, the prevalence of tooth wear and dentin exposure is presented, at 83.5% and 58.8%, respectively, with mean teeth at 1.3 ± 0.6 and 0.2 ± 0.2. Tooth wear, mean teeth, and dentin exposure was higher in older (over 36 years old) vs younger (under 25 years old) individuals, although the differences were only statistically significant for mean teeth of dentin exposure (p = 0.157, 0.373, 0.084, and 0.037, respectively). When comparing gender differences, the prevalence of tooth wear, mean teeth of tooth wear, dentin exposure, and mean teeth of dentin exposure were all higher in males than in females, with statistically significant differences (p < 0.001, < 0.001, 0.003, and < 0.001, respectively). As for education differences, the prevalence of tooth wear, dentin exposure, and mean teeth affected, were better for those with high school or under degree, with no statistically significant differences (p = 0.232, 0.107, 0.133, and 0.504, respectively). Occupation of participants showed controversial findings, as there were no statistically significant differences for prevalence of tooth wear or mean teeth of dentin exposure (p = 0.322 and 0.090). Yet, mean teeth showing tooth wear and dentin exposure were statistically significant (p = 0.002 and < 0.001). The four first molars had the highest mean TWI scores: 16 (1.5 ± 0.9), 26 (1.6 ± 0.8), 36 (1.6 ± 0.8), and 46 (1.6 ± 0.8). These were followed by the second molars and canines.

In Table 2, gender was significantly associated with the risk of tooth wear, where males' OR was almost 4 times that of females (OR=3.8, 95% CI 2.3–6.4). Level of education was also significantly associated with the risk of tooth wear, where those with a high school degree or under had twice the odds vs those with a college degree (OR=2.5, 95% CI 1.2–5.0).

In Table 3, according to the regression analysis results, age (OR for males vs females = 3.2, 95% CI 1.9–5.5) and level of education (OR of high school vs college degree = 3.3, 95% CI 1.6–7.0) were significantly associated with risk of tooth wear. However, other demographics and oral health behavior were not significantly associated with the risk of tooth wear.

Discussion

The current cross-sectional study represents the notable prevalence of tooth wear in the Eastern Province of

Table 1 The Prevalence and Means of Tooth Wear and Dentin Exposure Between Different Demographic Variables

	N (%)	Tooth Wear				Dentin Exposure			
		Prevalence %	P	Mean Tooth	P	Prevalence %	P	Mean Tooth	P
Age group			0.157		0.373		0.084		0.037*
Under 25 yrs	74 (21.8)	77.0		1.2±0.6		45.9		0.1±0.1	
26–30 yrs	95 (27.9)	81.1		1.3±0.6		61.1		0.2±0.2	
31–35 yrs	120(35.3)	86.7		1.4±0.6		62.5		0.2±0.2	
Over 36 yrs	51 (15.0)	90.2		1.4±0.6		64.7		0.2±0.2	
Gender			<0.001*		<0.001*		0.003*		<0.001*
Male	187 (55.0)	91.4		1.6±0.4		65.8		0.2±0.2	
Female	153 (45.0)	73.9		1.0±0.7		50.3		0.1±0.1	
Education			0.232		0.107		0.133		0.504
High school and under	74 (21.8)	81.1		1.5±0.7		50.0		0.1±0.2	
Diploma degree	82 (24.1)	79.3		1.3±0.6		57.3		0.1±0.2	
College degree	183 (53.8)	86.9		1.3±0.6		63.4		0.2±0.2	
Occupation			0.322		0.002*		<0.001*		0.090
Employed	189 (55.6)	85.7		1.4±0.5		61.4		0.1±0.2	
Unemployed	68 (20.0)	85.3		1.3±0.6		72.1		0.2±0.2	
Student	48 (14.1)	81.3		1.3±0.8		33.3		0.1±0.2	
Stay home mom/dad	34 (10.0)	73.5		1.0±0.8		55.9		0.2±0.2	
Total	340	83.5		1.3±0.6		58.8		0.2±0.2	

Note: *Significant p-value.

Saudi Arabia. Based on preliminary results, tooth wear is extremely high (83.5%) in the sample of examined adults. The percentage of tooth wear in this study falls in the range from 57% to 85%.[6–8,10–12,16] Results are considered at the higher end of reported worldwide prevalence, reflecting worse oral health in this age group. We must understand that the incidence of tooth wear increases with age, such that it can be expected in dentition of this population.

The first risk factor examined was age, as there was an increase in the proportion of participants with tooth wear with age, but with no statistically significant association. On the other hand, a positive correlation between tooth wear and age was observed in similar studies, showing statistical significance ($p < 0.05$).[17–19] This positive correlation can be explained by aging, as adults are exposed to various etiological factors, which result in the deterioration of teeth function and structure, as well as aesthetics over time.[20]

There was also a noticeable difference in tooth wear by gender, in which males showed significantly higher rates than females, with an OR of 3.8, higher than reported earlier by Al-Omari et al,[4] and Schierz et al,[17] (1.8 and 1.7, respectively). The difference between males and females can be explained by how males experience greater masticatory forces than females, with different

contributing risk factors, eg, stress and diet.[21] The difference between genders is also that males either delay or avoid dental services, until tooth wear becomes severe.[22]

Interestingly, tooth wear was negatively associated with level of education ($p = 0.013$), which coincides with several other studies.[4,23–25] This is in contrast with one study in the UK, evaluating the impact of tooth wear on patients' quality of life and acceptance of their dentition, where level of education was positively correlated to tooth wear severity ($r= 0.252$, $p=0.02$).[4] The negative association with level of education was seen in two studies in Nigeria, one in a rural community and the other a national survey of tooth wear in young adults, suggesting a significant association ($p < 0.05$).[23,24] Overall, education level was reported to be linked to several health outcomes, where rates differed between high and low education levels.[25] Educated individuals tend to consume a healthier diet in addition to practicing better oral hygiene, which would also protect their teeth.

Occupation and tooth wear showed no significant correlation in this study, as there were no differences in tooth wear between the employed or unemployed. This is consistent with previous results, where there was no statistically significant association between occupation and tooth wear ($p > 0.05$), as seen in a study in Nigeria, and another

Table 2 The Relationship Between Risk Levels of Tooth Wear (None and Low, Medium and High) and Demographics, Oral Health Behaviors

Demographics, Oral Health Behaviors	N	Tooth Wear Levels	OR	95% CI		P
		Medium and High (%)		Lower	Upper	
Age group						0.444
Under 25 yrs	74	45 (60.8)	0.5	0.2	1.3	0.181
26–30 yrs	95	60 (63.2)	0.8	0.4	1.7	0.512
31–35 yrs	120	81 (67.5)	1.0	0.5	2.1	0.954
Over 36 yrs [a]	51	35 (68.6)				
Gender						
Male	187	145 (77.5)	3.8	2.3	6.4	<0.001*
Female [a]	153	76 (49.7)				
Education						0.013*
High school and under	74	56 (75.7)	2.5	1.2	5.0	0.013
Diploma degree	82	50 (61.0)	0.8	0.4	1.6	0.547
College degree [a]	183	115 (62.8)				
Occupation						0.149
Employed	189	128 (67.7)	1.3	0.7	2.5	0.432
Unemployed	68	45 (66.2)	1.7	0.7	4.1	0.209
Student	48	32 (66.7)	0.5	0.2	1.2	0.129
Stay home mom/dad [a]	34	16 (47.1)				
Frequency of brushing						0.660
Less than once daily [a]	9	9 (100.0)				
Once daily	91	63 (69.2)	Sig. OR	0.0	0.0	0.999
Twice daily	161	101 (62.7)	1.5	0.8	2.9	0.237
3 times daily or more	77	47 (61.0)	1.1	0.6	2.0	0.727
Type of toothbrush						
Manual toothbrush	317	206 (65.0)	1.7	0.5	5.2	0.387
Electric toothbrush [a]	13	7 (53.8)				
Fluoride toothpaste						
Yes [a]	254	163 (64.2)				
No	18	13 (72.2)	1.6	0.5	5.6	0.449
Fluoride aids						
Yes	20	13 (65.0)	0.9	0.3	2.3	0.767
No [a]	230	149 (64.8)				
Number of dental visits in the last 12 months						0.204
No dental visits [a]	126	77 (61.1)				
1–2 dental visits	109	74 (67.9)	1.1	0.6	1.9	0.820
3 or more dental visits	102	68 (66.7)	0.7	0.4	1.2	0.169

Notes: [a]Control group, *Significant p-value.

one in the UK.[23,26] Occupation and tooth wear showed a strong association in two studies involving blue collar workers.[27,28]

There was no significant association between tooth wear and oral hygiene habits, such as frequency of toothbrushing, type of toothbrush, use of fluoridated toothpaste or fluoride aids in this study. One of the major causes of tooth wear in the cervical area contributed to its severity and toothbrushing distribution.[29] Tooth wear may also be related to other factors, such as toothbrush bristle design, dentifrice abrasives, and brushing technique, time, and frequency.[29]

In this study, there was no significant connection between tooth wear and frequency of dental visits over the last 12 months. This was also reported in two studies

Table 3 The Cumulative Multivariate Logistic Regression Model: Dependent Variable: Tooth Wear Levels (None and Low, Medium and High)

	Tooth wear Levels	OR	95% CI		P
	Medium and High (%)		Lower	Upper	
Total	221 (65.0)				
Gender					
Male	145 (77.5)	3.2	1.9	5.5	<0.001*
Female [a]	76 (49.7)				
Education					0.006*
High school and under	56 (75.7)	3.3	1.6	7.0	0.002*
Diploma degree	50 (61.0)	1.1	0.6	1.9	0.833
College degree [a]	115 (62.8)				

Notes: [a]Control group, *Significant p-value.

conducted in China and the UK, where frequency of dental visits did not affect the rate of tooth wear.[9,30]

Limitations

This study did not cover all aspects of tooth wear, with possible risk factors such as para-functional habits as well as lifestyle habits, which could harm dentition. The study was focused on adults, as well as the older population. Severity of tooth wear will be assessed in future studies, as its complex nature is challenging; detecting cases based on "mechanical vs chemical" wear was problematic for clinical examiners in the data collection phase. We must conduct more in vitro and in vivo tooth wear studies to comprehend the different types of investigations.

Conclusion

The prevalence of tooth wear among sampled adults is high. There are clear gender and education level differences in tooth wear, noticed at both bivariate and multivariate levels. The results of this study are alarming, although it is still recommended that more research be carried out.

The adult population will eventually age, so teeth retention will routinely increase long-term benefits of the oral cavity. A lifelong strategy, with early identification and prevention, is necessary to avoid the consequences of tooth wear in older adults.

Disclosure

The author reports no conflicts of interest for this work.

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