



PATTERNS AND LOCATION OF DENTAL ABRASION: A CROSS-SECTIONAL STUDY

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ABSTRACT Dental abrasion refers to the gradual wearing away of tooth structure due to external mechanical actions unrelated to chewing. Improper brushing techniques, excessive brushing pressure, and abrasive oral hygiene aids are common contributing factors. The patterns and location of dental abrasion may vary depending on causative factors and duration of exposure. **Aim:** To assess the prevalence, severity, patterns, and location of dental abrasion among adults aged 18 years and above and to evaluate its association with oral hygiene practices using the Smith and Knight Tooth Wear Index. **Methods:** A cross-sectional observational study with questionnaire-based data collection was conducted among 128 participants aged 18 years and above. Information regarding brushing habits, toothbrush type, brushing technique, brushing pressure, duration of brushing, and use of oral hygiene aids was collected using a structured questionnaire. Clinical examination was performed to assess dental abrasion using the Smith and Knight Tooth Wear Index. The collected data were analyzed to evaluate the pattern and severity of abrasion, the surfaces/regions affected, and the number of teeth involved. **Results:** Moderate dental abrasion was the most prevalent finding among participants. Cervical lesions affecting the buccal surfaces were predominantly observed, with premolars and canines being the most commonly affected teeth. Horizontal brushing technique, use of hard toothbrushes, and excessive brushing pressure were associated with increased abrasion severity. Tooth sensitivity and notching near the gumline were common symptoms. **Conclusion:** Dental abrasion was highly prevalent among the study population and was significantly associated with improper brushing habits and excessive brushing pressure. Early diagnosis and patient education regarding appropriate brushing techniques and oral hygiene practices are important for prevention and management.

KEYWORDS : Dental Abrasion, Tooth Wear, Cervical Lesions, Brushing Habits, Smith And Knight Index, Tooth Sensitivity

INTRODUCTION

Dental abrasion is the pathological loss of tooth structure caused by mechanical forces other than mastication. It commonly occurs due to improper tooth brushing techniques, excessive brushing pressure, abrasive dentifrices, and habits involving foreign objects. The cervical portions of premolars and canines are commonly involved, as these regions are more vulnerable to continuous mechanical stress [1,2].

With improved tooth retention and evolving oral hygiene habits, tooth wear has emerged as a growing oral health concern. Previous studies have reported that the prevalence and severity of pathological tooth wear increases with age and may affect both the functional and esthetic aspects of dentition [3,4]. Improper brushing methods, especially horizontal brushing techniques and the use of hard-bristled toothbrushes, have been strongly associated with cervical abrasion lesions [5]. Since enamel and dentin cannot regenerate naturally, dental abrasion is considered an irreversible condition. Initially, lesions may remain asymptomatic; however, progression can result in dentinal hypersensitivity, discoloration, impaired function, and esthetic concerns [5]. The Smith and Knight Tooth Wear Index is widely used for the clinical assessment of tooth wear severity and provides a standardized method for evaluating abrasion lesions in epidemiological and clinical studies [2]. Despite increasing awareness regarding oral hygiene maintenance, faulty brushing practices and improper use of oral hygiene aids remain common. Limited data are available regarding the patterns and locations of dental abrasion among the adult population in the studied region. Therefore, the present study was conducted to assess the prevalence, severity, patterns, and location of dental abrasion among adults aged 18 years and above and to evaluate its association with oral hygiene practices using the Smith and Knight Tooth Wear Index.

MATERIAL AND METHODS:

Study Design: A cross-sectional observational study was conducted to assess the prevalence, patterns, severity and location of dental abrasion among adults using the Smith and Knight Tooth Wear Index.

Study Setting and Duration: The present study was conducted in the Department of Oral Medicine and Radiology and at community dental screening camps from February 2026 to April 2026.

Study Population: The study population consisted of individuals aged 18 years and above who were willing to participate in the study. Both male and female participants with natural teeth present for clinical examination were included. Informed consent was obtained from all participants before clinical examination and data collection. Participant confidentiality was maintained throughout the study.

Sample Size: The sample size was calculated using the standard formula for prevalence studies:

$$n = Z^2pq \div d^2$$

Where

n = required sample size

Z = standard normal deviate at 95% confidence interval (1.96)

p = estimated prevalence of dental abrasion

q = 1 - p

d = allowable error (precision)

Since the exact prevalence of dental abrasion was not known, p = 50% was considered to obtain the maximum sample size.

$$n = (1.96)^2 \times 0.5 \times 0.5 \div (0.086)^2 \approx 130$$

Thus, the calculated sample size was approximately 130 participants. Based on feasibility and participant availability, 128 participants were included in the study using convenience sampling based on eligibility criteria and willingness to participate.

Inclusion Criteria:

- Individuals aged 18 years and above
- Participants willing to provide informed consent
- Participants with natural teeth present for clinical examination
- Individuals available during the study period

Exclusion Criteria:

- Individuals below 18 years of age
- Completely edentulous patients
- Patients undergoing orthodontic treatment
- Teeth with extensive restoration or crowns affecting assessment
- Individuals unwilling to participate or give consent

Method of Data Collection

A pre-validated questionnaire was used for data collection, after which participants underwent a clinical oral examination (Annexure 1). The questionnaire was divided into the following sections:

Section A: Demographic details, including age and gender.

Section B: Oral hygiene habits, including type of toothbrush, type of toothpaste, frequency and duration of brushing, and brushing pressure.

Section C: Brushing techniques used by the participants, including horizontal, vertical, circular, and combined techniques.

Section D: Presence of symptoms associated with dental abrasion, including tooth sensitivity, notching near the gumline, discoloration of teeth, and thinning or flattening of tooth edges.

Section E: Clinical examination findings, including Smith and Knight Tooth Wear Index score, abrasion severity, affected surfaces, number of teeth involved, teeth commonly affected, and pattern of abrasion.

After recording questionnaire responses, each participant underwent an oral examination to assess dental abrasion and its location. The severity of tooth wear was recorded using the Smith and Knight Tooth Wear Index. After examination, participants were educated regarding proper brushing techniques, the use of suitable oral hygiene aids, and preventive measures to reduce further dental abrasion.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 25. Descriptive statistics were expressed as frequency and percentage. Independent t-test, chi-square test, and binary logistic regression analysis were used for statistical analysis. A p-value of <0.05 was considered statistically significant.

RESULTS

The present study included 128 participants, with a higher proportion of males (58.6%) compared to females (41.4%). The majority of participants belonged to the 31–45 years age group (44.5%), followed by 46–60 years (32.8%), indicating that middle-aged individuals formed the largest study population. (Table 1).

Table 1. Oral Hygiene Practices of the Study Population

Variable	Category	Frequency (n)	Percentage (%)
Toothbrush Type	Soft	10	7.8%
	Medium	50	39%
	Hard	68	53.1%
Toothpaste type	Fluoridated	85	66%
	Herbal	26	20%
	Abrasive powder	17	13%
Frequency	Once	67	52%
	Twice	56	44%
	More than twice	5	4%
Duration	1 min	8	6%
	1-2 min	60	47%
	>2 min	60	47%
Pressure	Gentle	8	6%
	Moderate	93	73%
	Hard	27	21%
Additional tools used	Toothpick	6	5%
	Dental floss	1	1%
	Mouthwash	3	2%
	None	118	92.2%

Regarding oral hygiene practices, most participants used hard toothbrushes (53.1%), while only a small proportion used soft brushes (7.8%). This suggests a tendency toward the use of more abrasive brushing tools, which may contribute to tooth wear. Similarly, fluoridated toothpaste was most commonly used (66%), while the use of abrasive powders was noted in 13% of participants. In terms of brushing habits, over half of the participants brushed once daily (52%), and 44% brushed twice daily. Most individuals reported brushing for 1–2 minutes or longer (94%), but brushing technique and applied force appear to play a more critical role. A large proportion of participants applied moderate pressure (73%), while 21% used greater hand pressure, which may contribute to abrasion. The use of additional oral

hygiene aids was minimal, with very few participants using dental floss (1%) or mouthwash (2%), indicating limited adoption of comprehensive oral care practices. (Table 1).

Table 2. Distribution of Brushing Techniques and Symptoms Among Study Population

Variable	Category	Frequency (n)	Percentage (%)
Brushing Technique	Horizontal	80	63%
	Vertical	17	13%
	Circular	14	11%
	Combined	17	13%
Symptoms	Tooth sensitivity	33	26%
	Notching near gumline	81	63%
	Discoloration of teeth	1	1%
	Thinning of tooth edges	13	10%

Table 2 evaluates brushing techniques among the study population. The majority used a horizontal brushing method (63%), which is known to be associated with cervical abrasion, whereas recommended techniques like circular brushing were less common (11%). Clinically, the most commonly reported symptom was cervical notching near the gumline (63%), followed by tooth sensitivity (26%), suggesting that cervical abrasion is a prominent issue in this population.

Table 3. Distribution of Abrasion Severity, Affected Area and Patterns of Abrasion

Variable	Category	Frequency (n)	Percentage (%)
Abrasion Severity	No	2	2%
	Mild	46	36%
	Moderate	62	48%
	Severe	18	14%
Affected Area	Buccal	11	9%
	Palatal/Lingual	1	1%
	Occlusal/Incisal	1	1%
	Cervical	115	90%
Patterns of Abrasion	V shape	104	79%
	Horizontal scratches or groove	14	11%
	Occlusal	4	3%
	Interdental	1	1%
	Generalized surface wear	8	6%

The assessment of abrasion severity revealed that most participants had moderate abrasion (48%), followed by mild (36%) and severe (14%), with very few showing no abrasion. This indicates a high prevalence of tooth wear among the study population. The cervical region was the most commonly affected area (90%), and V-shaped lesions (79%) were the predominant pattern observed. The results indicate a strong association between improper brushing habits and the development of dental abrasion (Table 3).

Table 4. Comparison of the Mean Age Between Abrasion Severity Groups

Group	Mean age $\pm$ SD	p value
Mild	36.10 $\pm$ 9.61	
Moderate/Severe	48.10 $\pm$ 9.38	<0.001

Independent samples t-test. Significance level set at $p < 0.05$.

Table 4 shows that the mean age of participants with mild abrasion was 36.10 $\pm$ 9.61 years, whereas participants with moderate/severe abrasion had a significantly higher mean age of 48.10 $\pm$ 9.38 years. The difference in mean age between the two groups was statistically highly significant ($p < 0.001$), indicating that increasing age is significantly associated with greater abrasion severity.

Table 5. Association Between Age Group and Abrasion Severity

Variable	Mild n (%)	Moderate/Severe n (%)	Total n (%)	p value
18–30 yrs	17 (100.0%)	0 (0.0%)	17 (100.0%)	
31–45 yrs	23 (40.4%)	34 (59.6%)	57 (100.0%)	
46–60 yrs	6 (14.3%)	36 (85.7%)	42 (100.0%)	
>60 yrs	2 (16.7%)	10 (83.3%)	12 (100.0%)	<0.001

A Chi-square test was performed ($df = 3$). Significance level was set at $p < 0.05$.

Table 5 shows a statistically significant association between age group and abrasion severity ($p < 0.001$). Participants aged 18–30 years had only mild abrasion (100.0%), with no cases of moderate/severe abrasion observed in this group. In the 31–45 years age group, 40.4% had mild abrasion, while 59.6% had moderate/severe abrasion. Among participants aged 46–60 years, the majority (85.7%) had moderate/severe abrasion, with only 14.3% showing mild abrasion. Similarly, in participants older than 60 years, 83.3% had moderate/severe abrasion and 16.7% had mild abrasion. These findings indicate that increasing age is significantly associated with greater abrasion severity.

Among female participants, 22 (41.5%) had mild abrasion, while 31 (58.6%) had moderate/severe abrasion. Among male participants, 26 (34.7%) had mild abrasion, whereas 49 (65.3%) had moderate/severe abrasion. Although a higher proportion of males showed moderate/severe abrasion compared to females, the association between gender and abrasion severity was not statistically significant ($p = 0.367$).

The majority of participants, 118 (92.2%), did not use any additional oral hygiene aids, whereas only 10 (7.8%) reported using them. This indicates limited use of supplementary oral hygiene practices among the study population.

Table 6. Distribution of Number of Teeth Involved

Category	Frequency (n)	Percentage (%)
≤5 teeth	24	18.8%
6–10 teeth	47	36.7%
>10 teeth	57	44.5%

Table 6 shows that 24 participants (18.8%) had abrasion involving ≤ 5 teeth, 47 participants (36.7%) had involvement of 6–10 teeth, and 57 participants (44.5%) had involvement of more than 10 teeth. These findings suggest that a considerable proportion of participants had extensive tooth involvement due to abrasion.

Table 7. Binary Logistic Regression Analysis For Predictors of Abrasion Severity and Type of Abrasion

Variable	Category	AOR	95% CI	p value
Age (years)	Continuous	1.153	1.087–1.22	<0.001
Gender	Female	—	—	—
	Male	1.529	0.608–3.842	0.367
Tooth Brush Type	Soft	—	—	—
	Medium	0.742	0.301–1.829	0.517
	Hard	0.529	0.255–1.097	0.087
Brushing Pressure	Gentle	—	—	—
	Moderate	0.612	0.241–1.553	0.302
	Hard	0.379	0.154–0.931	0.034
Type of abrasion	V-shaped	—	—	—
	Horizontal scratches	0.614	0.242–1.558	0.306
	Occlusal wear	0.487	0.118–2.012	0.321
	Interdental	0.221	0.025–1.958	0.178
	Generalized wear	0.736	0.301–1.801	0.503

Values with $p < 0.05$ are considered significant.

Binary logistic regression analysis (Table 7) identified age and brushing pressure as significant predictors of abrasion severity. Age showed a statistically significant association with abrasion severity (AOR = 1.153; $p < 0.001$), indicating that for every one-year increase in age, the odds of developing moderate to severe abrasion increased by approximately 15.3%. Gender was not significantly associated with abrasion severity ($p = 0.367$), although males demonstrated higher odds compared to females. This suggests that after adjusting for other variables, gender did not independently influence the severity of abrasion.

Among oral hygiene practices, toothbrush type did not reach statistical significance, although the use of hard toothbrushes showed a trend toward association ($p = 0.087$), suggesting that the brushing technique and applied force may be more important contributing factors.

Brushing pressure showed a statistically significant association with abrasion severity ($p = 0.034$), indicating that brushing force plays an important role in the progression of dental abrasion.

No statistically significant association was observed between the type of abrasion and abrasion severity ($p > 0.05$ for all categories). Although

V-shaped lesions were the most common abrasion pattern and used as the reference category, other abrasion patterns, such as horizontal scratches, occlusal wear, interdental lesions, and generalized wear were not independently associated with increased severity.

The results demonstrated that age and brushing pressure were significantly associated with abrasion severity, while other factors, such as brushing frequency and brushing technique, showed trends toward association but did not demonstrate independent statistical significance.

DISCUSSION

This study evaluated the prevalence and characteristics of dental abrasion among adults and examined their association with oral hygiene practices using the Smith and Knight Tooth Wear Index. The findings revealed that moderate abrasion was the most frequently observed condition. Cervical lesions on buccal surfaces and V-shaped defects were the predominant clinical findings, suggesting a strong association between brushing habits and tooth wear.

Horizontal brushing was the most commonly reported brushing technique among participants. Similar observations were reported by Bergström J and Lavstedt S, who identified horizontal brushing movements as a major factor contributing to cervical abrasion lesions because of repeated frictional forces on tooth surfaces (6). The predominance of cervical lesions in the current study also corresponds with the findings of Bartlett D and Shah P, who stated that cervical regions are more vulnerable to mechanical tooth wear due to reduced enamel thickness in these areas (11).

V-shaped abrasion defects were the most common pattern identified in the present study. Comparable findings were reported by Saxena V et al. (2013), who observed that wedge-shaped cervical lesions are frequently linked to traumatic brushing methods and increased brushing force (8). In addition, Borcić J et al. (2004) found that premolars and canines are more commonly involved because these teeth are subjected to greater brushing stress during oral hygiene procedures (9).

The present study demonstrated a significant association between increasing age and the severity of abrasion. Older participants showed a greater prevalence of moderate and severe lesions, indicating the cumulative effect of mechanical wear over time. This finding is in agreement with Van't Spijker A et al. (2009), who reported that the severity of tooth wear tends to rise with advancing age due to prolonged exposure to etiological factors (4). Brushing pressure was also significantly associated with abrasion severity, which supports the observations of David K et al. (2002), who identified excessive brushing force as an important contributing factor for cervical abrasion (7).

Tooth sensitivity and notching near the gumline were frequently reported symptoms in this study. Similar findings were described by Nascimento MM et al. (2016), who noted that exposure of dentin in cervical lesions commonly results in hypersensitivity and structural defects (5).

One of the major strengths of this study was the combined use of the standardized Smith and Knight Tooth Wear Index, questionnaire-based assessment, and clinical examination. However, the study was limited by convenience sampling and a geographically restricted population, which may reduce the general applicability of the findings. Further longitudinal studies with larger and more diverse populations are recommended to better evaluate the multifactorial etiology and progression of dental abrasion. The present study supports the association between oral hygiene practices and dental abrasion among adults.

CONCLUSION

The findings of the present study indicate that dental abrasion is highly prevalent among adults and commonly presents as cervical V-shaped lesions affecting the buccal surfaces of premolars and canines. Moderate abrasion was the most frequently observed severity. Age, brushing pressure, and toothbrush type were identified as significant factors associated with increased severity of dental abrasion, emphasizing the cumulative and mechanical nature of the condition. Although brushing technique and brushing frequency were not statistically significant predictors, oral hygiene practices still appear to contribute to the development of abrasion lesions.

The study highlights the importance of educating patients about correct brushing methods, the use of soft-bristled toothbrushes, and minimizing excessive brushing pressure. Early diagnosis and preventive counseling are important to preserve tooth structure and reduce the progression of dental abrasion.

ANNEXURE 1

Sec A: Demographic details

- 1) Name:
- 2) Age:
- 3) Gender:
- 4) Occupation:

Sec B: Oral hygiene habits

- 1) Type of toothbrush used? Soft/Medium/Hard / Electric
- 2) Type of toothpaste used?
Fluoridated/Herbal/Abrasive powders
- 3) Frequency of brushing in a day? Once/Twice/More than twice/occasionally
- 4) Duration of brushing? Less than 1 min/1-2 min/more than 2 min
- 5) How much pressure do you apply while brushing?
Gentle/moderate/Hard
- 6) Do you use any additional oral hygiene tools?
Toothpicks/Dental floss/Mouthwash/Other

Sec C: Brushing techniques

- 1) Brushing Techniques used? Horizontal/ Vertical/ Circular/ Combined
- 2) Have you been trained or advised by a Dentist? Yes/No

Sec D: Symptoms and awareness

- 1) Have you noticed any of the following?
Tooth sensitivity/ notching near gum line/ discolouration of teeth/thinning or flattening of teeth edges/ None of above

Sec E: Clinical examination

Smith and Knight Tooth index

CONCLUSION

Smith and Knight tooth wear index score

- 1) Abrasion severity: Mild / Moderate/ Severe
- 2) Affected surface: Buccal / palatal or Lingual / Occlusal or Incisal / Cervical
- 3) No. of teeth involved
- 4) Tooth commonly affected
- 5) Patterns of abrasion

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