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Oral Hygiene Behaviors, Periodontal Awareness, and Self-Reported Periodontal Symptoms Among Adults: A Cross-Sectional Survey Study

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Highlights

What are the main findings?

- Higher periodontal awareness was strongly associated with optimal oral hygiene behaviors, particularly interdental cleaning and routine preventive dental attendance.
- Multivariable analysis identified smoking, irregular dental attendance, and absence of interdental cleaning as independent predictors of increased periodontal symptom burden.

What are the implications of the main findings?

- Periodontal awareness alone does not ensure effective disease prevention; translation of knowledge into sustained daily plaque-control behaviors is critical.
- Questionnaire-based screening may provide a scalable strategy for identifying high-risk individuals and optimizing targeted preventive interventions in periodontology.

Abstract

Objectives: The study aim was to investigate the relationship between oral hygiene behaviors, periodontal awareness, and self-reported periodontal symptoms among adults using a questionnaire and an internally consistent awareness scoring system. **Materials and Methods:** A cross-sectional questionnaire study was conducted for adults aged 18-65 years. The dataset comprised 412 respondents, of whom 386 questionnaires were complete and eligible for analysis. The survey included sociodemographic variables, toothbrushing frequency and duration, interdental cleaning, mouthrinse use, smoking, dental attendance patterns, previous periodontal treatment history, awareness of common periodontal signs, and self-reported symptoms. Awareness scores were calculated on a 0-20 scale. Descriptive statistics, chi-square analysis, one-way ANOVA, post hoc Tukey tests, and multivariable logistic regression were used with $p<0.05$. **Results:** Mean age was 31.8 +- 9.6 years; 58.0% of participants were women. Twice-daily toothbrushing was reported by 56.0%, while 38.6% used interdental cleaning aids. The mean periodontal awareness score was 12.7 +- 3.8. Higher awareness scores were observed among respondents with university education, regular dental attendance, and interdental cleaning habits ($p<0.001$). Gingival bleeding was the most frequently reported symptom (47.4%), followed by dentin hypersensitivity (33.9%) and halitosis (29.8%). In multivariable analysis, irregular dental attendance, current smoking, and absence of interdental cleaning independently increased the odds of reporting at least one periodontal symptom. **Conclusions:** Within the limits of this survey-based study, better oral hygiene behaviors and regular preventive dental attendance were associated with stronger periodontal awareness and a lower burden of self-reported periodontal symptoms. Public-health strategies in periodontology should address not only knowledge deficits but also the translation of knowledge into daily plaque-control behavior.

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Introduction

Periodontal diseases are chronic inflammatory disorders of the tooth-supporting tissues and remain among the most common oral conditions affecting adults worldwide. Severe periodontitis is highly prevalent at the population level and is an important contributor to tooth loss, impaired oral function, reduced quality of life, and increased treatment need [1–4]. The contemporary classification framework also emphasizes that periodontal health, gingivitis, and periodontitis should be interpreted as biologically and clinically continuous states influenced by host susceptibility, plaque accumulation, and behavioral risk factors [2–4].

Dental plaque biofilm is the principal etiologic factor in gingival inflammation, and the classic experimental gingivitis studies demonstrated that cessation of oral hygiene quickly induces visible inflammation, while reinstitution of plaque control reverses the process [5,6]. On that basis, daily mechanical plaque removal remains the cornerstone of primary and secondary prevention in periodontology. [7,8] However, effective plaque control is not merely a technical issue. It is also a behavioral phenomenon shaped by motivation, health literacy, perceived susceptibility, socioeconomic context, and the regularity of professional reinforcement [8–11].

Public awareness of periodontal disease is often incomplete. Many adults recognize dental caries as a health problem but fail to identify early periodontal signs such as gingival bleeding, swelling, recession, or tooth mobility as indicators requiring professional care [12–15]. This limited awareness may delay help-seeking behavior, reduce adherence to preventive advice, and contribute to the normalization of chronic symptoms. Self-reported bleeding during brushing, oral malodor, or tooth mobility can therefore be viewed not only as possible symptom markers but also as windows into the patient's level of disease recognition and care-seeking behavior [12,13,16].

Survey studies provide a practical way to evaluate how individuals perceive periodontal health, which behaviors they adopt, and how these factors cluster in the community. Although questionnaire data cannot replace full-mouth clinical examination, well-designed surveys can identify behavioral patterns, education gaps, and potentially vulnerable groups that may benefit from targeted oral-health promotion [12,16–19]. Such information is especially valuable for preventive periodontology because interventions are often more successful when they are tailored to observable behavior profiles rather than delivered as generic advice.

The literature has consistently linked tobacco exposure, infrequent dental attendance, poor interdental cleaning, and lower educational attainment with less favorable periodontal outcomes [9,10,18–23] At the same time, studies on self-reported periodontal disease suggest that specific symptom combinations may have acceptable screening utility when interpreted together with behavioral and demographic variables [12,16,17,24]. These observations support the idea that awareness, behavior, and symptom experience should be studied as interrelated constructs rather than isolated variables.

The present study was as a cross-sectional questionnaire survey to examine oral hygiene behaviors, periodontal awareness, and self-reported periodontal symptoms among adults. The primary objective was to determine whether better oral hygiene behaviors and preventive dental attendance were associated with higher awareness scores. The secondary objective was to explore predictors of self-reported periodontal symptom burden using multivariable analysis.

Materials and Methods

Study Design and Reporting Framework

This study was conducted as a cross-sectional survey study. The study design was conceptually aligned with STROBE recommendations for observational studies [25]. Written informed consent was obtained from all individuals, and the study protocol was approved by the Medical Ethics Committee of Tokat Gaziosmanpasa University (with the approval number 2015/KAEK/12-10)

Study Setting and Target Population

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The target population consisted of adults aged 18 to 65 years who were capable of reading and answering a self-administered questionnaire in Tokat Gaziosmanpasa University Faculty of Dentistry, Department of Periodontology outpatient setting and affiliated community environment. Recruitment was planned as consecutive convenience sampling over a defined data-collection period. Individuals who were fully edentulous, unable to complete the questionnaire independently, or unwilling to provide consent were excluded. To preserve questionnaire completeness and comparability, forms with more than 10% missing items were excluded from the final analysis.

Sample Size Rationale

The sample size was estimated on the basis of the primary comparison of awareness scores across oral-hygiene behavior groups. Assuming a medium effect size (f=0.25), a two-sided alpha level of 0.05, and statistical power of 0.80, a minimum sample of approximately 252 participants would be required for one-way ANOVA with three exposure categories. To allow for subgroup analysis, incomplete responses, and multivariable logistic regression, the planned enrollment was increased by at least 40%. A total of 412 forms were collected; 26 were excluded because of incomplete or inconsistent responses, leaving 386 questionnaires for final analysis.

Questionnaire Development

The questionnaire was developed after a focused literature review on oral-hygiene behavior, self-reported periodontal symptoms, and periodontal awareness instruments [12–19,26–30]. Draft items were generated in simple patient-centered language and then reviewed for content relevance by a periodontist.(M.M.T.) A pilot administration was conducted in 20 adults to assess clarity, completion time, and item redundancy. Minor wording revisions were made following pilot feedback, particularly for items addressing gingival bleeding, dental floss/interdental brush use, and prior periodontal treatment history.

The final questionnaire contained four main domains. The first domain covered demographic characteristics, including age, sex, education level, and smoking status. The second domain assessed oral-hygiene behaviors, including brushing frequency, average brushing duration, type of toothbrush, replacement interval of toothbrush head, use of interdental cleaning aids, and use of mouthrinse. The third domain evaluated dental attendance patterns and treatment history, such as routine check-up frequency, reason for the last dental visit, and whether the participant had ever received scaling or periodontal treatment. The fourth domain assessed periodontal awareness and self-reported symptoms.

Awareness Score Construction

Periodontal awareness was measured with 10 statements addressing basic concepts and warning signs, including the role of dental plaque in gingival inflammation, the abnormality of gingival bleeding, the preventive value of interdental cleaning, the contribution of smoking to periodontal disease risk, the significance of gingival recession, and the relationship between periodontitis and tooth mobility. Each correct response received 2 points, while incorrect or 'I do not know' responses received 0 points. The total awareness score therefore ranged from 0 to 20, with higher scores indicating greater awareness.

For interpretive purposes, awareness scores were also categorized into three bands: low awareness (0-8), moderate awareness (9-14), and high awareness (15-20). Internal consistency of the 10-item awareness scale was assessed using Cronbach's alpha. In the present dataset, the alpha coefficient was 0.81, suggesting good internal reliability for group-level comparisons.

Outcome Measures

The primary outcome was the continuous periodontal awareness score. The secondary outcome was self-reported periodontal symptom burden. Participants were asked whether they had

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experienced any of the following during the previous six months: gingival bleeding during brushing or spontaneously, gingival swelling, dentin hypersensitivity, persistent halitosis, gingival recession, food impaction between teeth, and tooth mobility. For regression analysis, a dichotomous dependent variable was created to indicate the presence of at least one periodontal symptom. A second exploratory variable indicated the presence of two or more symptoms, but this was used only in descriptive interpretation.

Data Collection Procedure

Eligible adults were informed about the study purpose and the voluntary nature of participation before receiving the questionnaire. Participants completed the form in a quiet waiting-area setting without discussion with other respondents. Completion time averaged 8 to 10 minutes. The research team checked questionnaires only for missing pages or unintentionally skipped items; no attempt was made to influence answers. Each form was coded numerically to preserve anonymity.

Statistical Analysis

Data analysis was carried out using IBM SPSS Statistics version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized as mean +- standard deviation, whereas categorical variables were expressed as number and percentage. Normal distribution of awareness scores was evaluated with histograms, skewness-kurtosis values, and the Kolmogorov-Smirnov test. Because the score distribution approximated normality and sample size was adequate, parametric testing was applied.

Between-group comparisons for categorical variables were performed with Pearson chi-square tests. Mean awareness scores were compared using the independent-samples t test for binary variables and one-way ANOVA for variables with more than two categories. Tukey post hoc analysis was used where relevant. Variables associated with self-reported periodontal symptoms at $p<0.10$ in univariable analysis, together with clinically important covariates identified a priori, were entered into a multivariable binary logistic regression model. The model included age group, sex, education level, smoking status, brushing frequency, interdental cleaning, and dental attendance pattern. Odds ratios (ORs) and 95% confidence intervals (95% CIs) were reported. Statistical significance was set at $p<0.05$ for all analyses.

Results

A total of 386 questionnaires were included in the final analysis. The mean age of the participants was 31.8 +- 9.6 years (range: 18-65 years), and 224 respondents (58.0%) were women. More than half of the sample had university-level education, and 24.4% were current smokers. Detailed demographic characteristics are presented in Table 1. **(Table 1)**

Table 1. Demographic characteristics of the study population.

Characteristic	n	%
Sex: Women	224	58.0
Sex: Men	162	42.0
Age group 18-24 years	96	24.9
Age group 25-34 years	154	39.9
Age group 35-44 years	82	21.2
Age group >=45 years	54	14.0

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Characteristic	n	%
Education: High school or lower	121	31.3
Education: University	214	55.4
Education: Postgraduate	51	13.2
Current smoking	94	24.4
Previous professional scaling/periodontal treatment	138	35.8

With regard to daily plaque-control behavior, 56.0% of participants reported brushing twice daily and 12.2% reported brushing three times or more, whereas 31.9% brushed once daily or less. Interdental cleaning aids were used by 38.6% of respondents, and 35.8% reported adjunctive mouthrinse use. Only 28.5% stated that they attended dental check-ups regularly every 6 months, while 42.5% sought dental care only when a complaint arose. **(Table 2)**

Table 2. Oral hygiene behaviors and dental attendance patterns.

Behavior variable	Category	n	%
Toothbrushing frequency	<=1 time/day	123	31.9
	2 times/day	216	56.0
	>=3 times/day	47	12.2
Brushing duration	<2 min	134	34.7
	2 min	177	45.9
	>2 min	75	19.4
Interdental cleaning aid use	Yes	149	38.6
	No	237	61.4
Mouthrinse use	Yes	138	35.8
	No	248	64.2
Dental attendance	Every 6 months	110	28.5
	Once yearly	112	29.0
	Only when complaint occurs	164	42.5

The mean periodontal awareness score for the total sample was 12.7 +- 3.8. According to the predefined categories, 22.0% of respondents had low awareness, 50.5% had moderate awareness, and 27.5% had high awareness. Correct recognition that gingival bleeding is not a normal finding was reported by 72.0% of respondents, whereas only 46.1% correctly identified smoking as a factor increasing periodontal disease risk. **(Table 3)**

Table 3. Correct response frequency for periodontal awareness items.

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Awareness item	Correct n	Correct %
Dental plaque can cause gingival inflammation.	301	78.0
Bleeding during toothbrushing is not a normal finding.	278	72.0
Periodontitis can lead to tooth mobility and tooth loss.	252	65.3
Interdental cleaning is beneficial in addition to toothbrushing.	243	63.0
Gingival recession may indicate periodontal tissue loss.	221	57.3
Smoking increases periodontal disease risk.	178	46.1
Regular professional maintenance helps prevent periodontal deterioration.	247	64.0
Periodontal disease may progress with little pain.	216	56.0
Halitosis can be associated with gingival/periodontal problems.	233	60.4
Plaque control is important even in the absence of pain.	278	72.0

Awareness scores differed significantly across behavior groups. Participants who used interdental cleaning aids had a markedly higher mean awareness score than non-users (14.8 +- 3.2 vs 11.4 +- 3.6, p<0.001). Likewise, those who attended routine preventive dental visits had higher scores than individuals who visited only for pain or treatment need (15.1 +- 3.0 vs 11.3 +- 3.7, p<0.001). Education level also showed a graded relationship with awareness score, with university graduates achieving the highest mean values. **(Table 4)**

Table 4. Comparison of mean periodontal awareness score across selected variables.

Variable	Group	Mean awareness score +- SD	p value
Education level	High school or lower	10.9 +- 3.5	<0.001
	University	13.3 +- 3.4	
	Postgraduate	15.0 +- 3.1	
Interdental cleaning	Yes	14.8 +- 3.2	<0.001
	No	11.4 +- 3.6	
Dental attendance	Every 6 months	15.1 +- 3.0	<0.001
	Once yearly	12.8 +- 3.4	
	Only when complaint occurs	11.3 +- 3.7	
Smoking status	Current smoker	11.5 +- 3.9	0.002
	Non-smoker/former smoker	13.1 +- 3.7	

Gingival bleeding was the most commonly reported symptom (47.4%), followed by dentin hypersensitivity (33.9%), halitosis (29.8%), and food impaction (28.8%). Tooth mobility was less frequent but still reported by 8.8% of respondents. The prevalence of at least one periodontal symptom was significantly higher among current smokers, non-users of interdental cleaning aids, and participants with complaint-based dental attendance. **(Table 5)**

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Table 5. Distribution of self-reported periodontal symptoms according to interdental cleaning habit.

Self-reported symptom	Overall n (%)	Interdental cleaning yes n (%)	Interdental cleaning no n (%)	p value
Gingival bleeding	183 (47.4)	52 (34.9)	131 (55.3)	<0.001
Gingival swelling	91 (23.6)	24 (16.1)	67 (28.3)	0.007
Dentin hypersensitivity	131 (33.9)	40 (26.8)	91 (38.4)	0.022
Halitosis	115 (29.8)	32 (21.5)	83 (35.0)	0.006
Food impaction	111 (28.8)	31 (20.8)	80 (33.8)	0.008
Gingival recession	86 (22.3)	25 (16.8)	61 (25.7)	0.045
Tooth mobility	34 (8.8)	8 (5.4)	26 (11.0)	0.071
At least one symptom	244 (63.2)	74 (49.7)	170 (71.7)	<0.001

In the multivariable logistic regression model, complaint-based dental attendance, current smoking, and lack of interdental cleaning remained significant independent predictors of self-reported periodontal symptom burden. Brushing once daily or less showed an elevated odds ratio but borderline statistical significance after adjustment, suggesting that interdental cleaning and care-seeking behavior may capture additional dimensions of preventive engagement beyond brushing frequency alone. **(Table 6)**

Table 6. Multivariable logistic regression analysis for presence of at least one self-reported periodontal symptom.

Predictor	Adjusted OR	95% CI	p value
Complaint-based dental attendance vs regular 6-month attendance	2.43	1.46 - 4.03	0.001
Once-yearly attendance vs regular 6-month attendance	1.41	0.84 - 2.36	0.192
Current smoking	1.96	1.17 - 3.29	0.011
No interdental cleaning	2.08	1.31 - 3.30	0.002
Brushing <=1 time/day	1.56	0.96 - 2.54	0.073
University/postgraduate education	0.78	0.49 - 1.26	0.313
Age >=35 years	1.19	0.74 - 1.93	0.471
Female sex	0.93	0.59 - 1.48	0.765

Discussion

The present survey study explored the intersection of oral-hygiene behavior, periodontal awareness, and self-reported symptom experience in an adult sample. The overall pattern of results suggests that awareness and behavior move in the same direction, but not perfectly. Respondents with more favorable plaque-control behavior and regular dental attendance had higher awareness

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scores, yet awareness was not universally translated into optimal daily practice. This discrepancy is clinically important, because preventive periodontology depends not only on what patients know, but also on whether that knowledge is sustained as routine self-care.

The mean awareness score observed in the present study may be interpreted as moderate rather than robust. Participants generally recognized obvious signs such as gingival bleeding, but showed weaker understanding of less visible or multifactorial elements such as the role of smoking and the long-term significance of gingival recession. This finding is consistent with conceptual model of periodontal disease progression [12–15]. In practice, this means that many individuals may respond to bleeding only when it becomes frequent, while underestimating the importance of persistent plaque control, regular maintenance, and modifiable risk factors.

The strong association between interdental cleaning and awareness score deserves special attention. Toothbrushing remains the most socially normalized oral-hygiene behavior, but interdental cleaning is often the behavior that best discriminates between basic and more advanced self-care routines. Systematic reviews have shown that interdental devices can provide additional plaque and gingival benefits when used appropriately as part of a broader oral-hygiene regimen [11,31,32]. In the present study, interdental cleaning was also associated with a lower symptom burden, suggesting that it may function both as a direct preventive behavior and as a behavioral marker of higher engagement with oral-health advice.

Dental attendance pattern emerged as another major correlate of both awareness and symptom experience. Individuals attending routine check-ups every six months had substantially higher awareness scores than those who sought care only for pain or treatment need. This observation is in line with public-health literature indicating that regular contact with oral-health professionals reinforces risk perception, self-efficacy, and preventive adherence [18,19,22,27]. Complaint-based attendance, by contrast, tends to reflect a problem-oriented treatment culture in which prevention is secondary. The regression results of the present study further suggest that irregular attendance is not merely a marker of low awareness; it may independently contribute to delayed recognition of gingival and periodontal deterioration.

The symptom profile also merits discussion. Gingival bleeding was the most frequently reported symptom, which agrees with the biological expectation that gingival inflammation is common and often precedes more advanced destructive disease [3–6,10]. However, symptom prevalence should not be interpreted as equivalent to clinical diagnosis. Self-reported measures are influenced by recall, symptom salience, individual thresholds for concern, and the tendency to normalize chronic discomfort [12,16,17,24]. Nonetheless, self-reported bleeding, oral malodor, food impaction, and tooth mobility remain meaningful indicators from a behavioral perspective because they often motivate care-seeking and shape perceived need.

The association between smoking and greater symptom burden is also consistent with the established role of tobacco as a major periodontal risk factor [9,21,23,33,34]. Tobacco exposure affects the host response, vascularity, microbial ecology, and treatment outcomes. While smokers may sometimes exhibit reduced overt bleeding because of vasoconstrictive effects, they remain at increased risk of periodontal destruction and tooth loss [23,33]. The finding that smoking knowledge was suboptimal within the awareness items suggests that tobacco-related periodontal counseling should be integrated more explicitly into patient education strategies.

Educational attainment showed a positive relationship with awareness score, although its independent contribution to symptom reporting was attenuated in multivariable analysis. This pattern is plausible. Education often exerts its effect through intermediate pathways such as health literacy, preventive orientation, access to information, and regular service utilization [8,18,22]. In other words, education may not protect against self-reported periodontal symptoms directly; rather, it may improve the likelihood of adopting behaviors that reduce risk. Such a pathway-based interpretation is compatible with social-determinants frameworks in oral health and emphasizes why communication must be adapted for different literacy levels.

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From a preventive periodontology perspective, the present findings support a multi-component intervention model. First, patient education should make explicit that gingival bleeding is not normal and that periodontitis can progress with relatively modest pain. Second, oral-hygiene instruction should move beyond generic advice and include practical coaching on interdental cleaning choice, frequency, and technique. Third, recall systems should be designed to shift patients from complaint-driven attendance to preventive attendance. Periodontal maintenance and early supportive care are unlikely to succeed when patients conceptualize dental visits primarily as emergency solutions rather than ongoing disease-prevention opportunities [7,10,20,35].

An additional implication concerns the use of questionnaire-based screening in large populations. Although clinical examination remains the diagnostic reference standard, short surveys that combine behavior items and symptom items may help identify high-risk groups for targeted education or referral. Prior validation studies suggest that self-reported periodontal disease performs better when multiple items are combined rather than used in isolation [12,16,24]. In that sense, the present questionnaire model may be useful as a preliminary community-screening or educational audit tool, especially when resources do not allow full-mouth examinations for every participant.

The study has several limitations. First, the cross-sectional design precludes causal inference; higher awareness may promote better behavior, but repeated exposure to preventive care may also improve awareness. Second, all symptom and behavior variables were self-reported and therefore subject to recall bias and social desirability bias. Third, the sample was based on convenience recruitment and may overrepresent adults already connected to dental services.

Despite these limitations, the study also has notable strengths. It integrates awareness, behavior, and symptom variables within a single analytic framework; it uses a transparent scoring system; and it reports multivariable associations rather than relying only on unadjusted comparisons. More importantly, it addresses a clinically relevant issue: many periodontal problems remain preventable, yet prevention fails when patients are insufficiently informed, insufficiently motivated, or insufficiently supported in converting knowledge into repeated daily behavior.

Future research should combine questionnaire methods with clinical periodontal examination to test how accurately awareness and symptom profiles map onto real periodontal status. Longitudinal designs would also be valuable for determining whether improvements in awareness precede behavioral change or merely accompany it. Finally, intervention studies should evaluate whether tailored educational messaging, reinforced by hygienist- or periodontist-led coaching, can increase interdental cleaning uptake and routine preventive attendance over time.

Conclusions

1. Adults with more favorable oral-hygiene behaviors, particularly interdental cleaning and regular preventive dental attendance, demonstrated higher periodontal awareness scores.
2. Self-reported periodontal symptoms were more common among current smokers, irregular dental attenders, and participants who did not use interdental cleaning aids.
3. Questionnaire-based assessment may provide a practical way to identify knowledge gaps and behavior profiles relevant to preventive periodontology.

Author Contributions: Conceptualization, methodology, investigation, data interpretation, drafting, critical revision, and final approval were specified by the submitting author. (M.M.T.).

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Institutional Review Board Statement: The study protocol was approved by the Medical Ethics Committee of Tokat Gazi-osmanpasa University (with the approval number 2025/KAEK/12-10, approved on 12 October 2025).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author in compliance with institutional ethical guidelines and data protection regulations.

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Conflicts of Interest: The author declare no conflict of interest related to this draft manuscript.

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