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Questionnaire Development and Exploratory Validation for Assessing Romanian Dental Students' Knowledge and Attitudes Toward Smoking and Periodontal Health

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Highlights

What are the main findings?

- The questionnaire demonstrated acceptable internal consistency (Cronbach's $\alpha = 0.770$) and a coherent exploratory factor structure.
- Dental students showed high periodontal knowledge but variable perceptions and heterogeneous attitudes toward smoking and alternative nicotine products.

What are the implications of the main findings?

- The instrument may serve as a reliable exploratory tool for assessing smoking-related knowledge, perceptions, and attitudes in dental populations.
- The findings highlight the need for improved educational strategies and enhanced training in smoking cessation and preventive dentistry.

Abstract

Introduction: Smoking is a major modifiable risk factor for periodontal disease, while perceptions, knowledge, and attitudes may influence smoking-related behaviors and preventive practices. The aim of this study was to develop and perform an exploratory validation of a questionnaire assessing these dimensions in relation to periodontal health. Methods: A cross-sectional survey was conducted using a structured, self-administered online questionnaire comprising 31 items. Internal consistency was evaluated using Cronbach's alpha coefficient, and construct validity was assessed through exploratory factor analysis using principal component analysis with Varimax rotation. Results: Sixty-six complete questionnaires were included in the analysis. The overall internal consistency of the instrument was good (Cronbach's alpha = 0.770). Reliability across individual domains ranged from acceptable to good. The Kaiser–Meyer–Olkin measure and Bartlett's Test of Sphericity confirmed the suitability of the data for factor analysis. Conclusions: The questionnaire demonstrates acceptable psychometric properties for exploratory use and may serve as a preliminary tool for assessing smoking-related perceptions, knowledge, and attitudes in relation to periodontal health.

Keywords: periodontal health; smoking; questionnaire development; exploratory validation

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1. Introduction

Smoking is widely recognized as one of the most significant modifiable risk factors affecting oral and general health. Its detrimental impact on periodontal tissues has been extensively documented, with strong evidence linking tobacco use to increased prevalence, severity, and progression of periodontal disease [1]. Smokers exhibit higher rates of gingival inflammation, attachment loss, alveolar bone resorption, and tooth loss, as well as a reduced response to periodontal therapy [2]. In addition, nicotine and other toxic constituents of tobacco products negatively influence immune responses, vascularization, and wound healing, further compromising periodontal health [3].

Beyond the biological mechanisms involved, individual perceptions, knowledge, and attitudes play a crucial role in shaping smoking behaviors and oral health practices. Awareness of the association between smoking and periodontal disease, understanding of clinical signs, and attitudes toward smoking cessation may influence both preventive behaviors and willingness to seek professional care [4,5]. Dental professionals, in particular, are uniquely positioned to contribute to smoking cessation efforts through patient education, early detection of periodontal disease, and motivational counseling [6].

Several systematic reviews and meta-analyses have consistently confirmed the strong association between tobacco consumption and periodontal disease [7,8]. Evidence indicates that smokers present a significantly higher prevalence and severity of periodontal destruction, including increased clinical attachment loss, alveolar bone resorption, and tooth loss, compared with non-smokers [8,9]. Furthermore, smoking has been associated with a reduced response to periodontal therapy and poorer outcomes following periodontal and implant treatments [10]. These findings highlight the complex biological and behavioral mechanisms through which tobacco use influences periodontal health and emphasize the importance of preventive and educational strategies targeting smoking behavior.

Despite the growing body of research on smoking and periodontal health, limited data are available regarding how young adults with a dental education background perceive the risks associated with smoking and alternative nicotine products [11,12].

In this context, assessing knowledge, perceptions, and attitudes related to smoking and periodontal health becomes particularly relevant, especially among individuals with a dental education background [13]. Understanding how future dental professionals perceive the relationship between smoking and periodontal disease may contribute to the development of more effective educational strategies and preventive interventions [14]. However, validated instruments specifically designed to assess these dimensions remain limited. The development of reliable and psychometrically sound questionnaires is therefore essential for systematically evaluating behavioral, perceptual, and attitudinal aspects related to smoking and oral health.

Furthermore, there is a need for validated instruments capable of systematically assessing perceptions, knowledge, and attitudes related to these topics within specific populations.

Therefore, the aim of the present study was to develop and preliminarily validate a structured questionnaire designed to assess perceptions, knowledge, and attitudes regarding the influence of smoking and nicotine-containing products on periodontal health. By exploring these dimensions, the study seeks to provide insights that may support future research, educational strategies, and preventive interventions in dental practice.

2. Materials and Methods

This study employed a systematic and structured methodological framework focused on the design, administration, and preliminary validation of a questionnaire aimed at exploring perceptions, knowledge, and attitudes regarding the effects of smoking and nicotine-containing products on periodontal health. The full questionnaire is provided in

Appendix A. The chosen methodological approach was intended to ensure standardized data collection, methodological transparency, and sufficient analytical robustness of the measurement instrument.

The research process included the identification of the target population and the establishment of inclusion criteria, the development of questionnaire items informed by the relevant scientific literature, and the dissemination of the survey in an online format. Subsequently, appropriate statistical procedures were applied to examine response distributions, internal coherence, and the reliability of the instrument. All stages of the study were conducted in accordance with established methodological principles and ethical standards, supporting the validity, reliability, and overall relevance of the study findings.

2.1. Study Design and Participant Selection

The present study was designed as a cross-sectional observational survey aimed at assessing perceptions, knowledge, and attitudes regarding the influence of smoking and nicotine-containing products on periodontal health. Data were collected using a structured, self-administered online questionnaire.

The survey was distributed via the Survio® online survey platform (Survio s.r.o., Brno, Czech Republic). and remained accessible for a period of 31 days. Participation was voluntary and anonymous. At the beginning of the questionnaire, participants were informed about the purpose of the study, the confidential handling of responses, and the exclusive use of the data collected for academic research. No personal identifying information was requested.

A total of 249 individuals accessed the questionnaire during the data collection period. Only fully completed questionnaires were considered eligible for analysis. After excluding incomplete or inconsistent responses, 66 valid questionnaires were retained and included in the final dataset.

The study sample was obtained using a convenience sampling approach, appropriate for exploratory research focused on instrument validation and descriptive analysis. The inclusion criterion consisted of complete questionnaire submission, while partially completed surveys were excluded from the analysis to ensure data integrity and comparability.

2.2. Development of the Research Instrument

The research instrument consisted of a structured, self-administered questionnaire entitled "The Influence of Smoking on Periodontal Health—Perceptions, Knowledge, and Attitudes". The questionnaire was developed based on a comprehensive review of relevant scientific literature addressing tobacco consumption, alternative nicotine-containing products, periodontal disease, and preventive strategies in dental practice.

The questionnaire included a total of 31 items, organized into clearly defined thematic sections. The first section comprised four socio-demographic items (Items 1–4) addressing age, gender, environment of origin, and educational level, which were used to characterize the study population and provide a contextual background for subsequent analyses.

The remaining questionnaire items were organized into distinct conceptual categories reflecting the main dimensions of the study.

- Smoking behavior and nicotine consumption patterns were assessed through seven items (Items 5–11), focusing on the presence, frequency, and types of nicotine-containing products used.
- Perceptions regarding alternative nicotine products were explored using six items (Items 12–17), which examined beliefs related to perceived harm, convenience, and motivations for choosing alternatives to conventional cigarettes.

- Oral hygiene practices and self-reported periodontal status were evaluated through five items (Items 18–22), addressing daily oral hygiene behaviors and participants' awareness of their periodontal condition.
- Knowledge related to periodontal disease was assessed using four items (Items 23–26), focusing on awareness of periodontal pathology and recognition of its main clinical signs and manifestations.
- Finally, attitudes toward smoking cessation and the preventive role of the dentist were examined through five items (Items 27–31), exploring perceptions of professional responsibility, dental student motivation, and the importance of public health awareness.

Most perceptual and attitudinal items were formulated as statements and evaluated using a five-point Likert scale (1 = strongly disagree; 5 = strongly agree). The phrasing of the items was intentionally kept clear and unambiguous, with each question addressing a single concept. A uniform response scale was applied across sections to facilitate comprehension and support the internal coherence of the instrument.

The wording of the questionnaire items was designed to ensure clarity and conceptual specificity, with each item addressing a single construct related to smoking behavior, periodontal knowledge, or attitudes toward smoking cessation.

In the context of this study, knowledge refers to participants' awareness and understanding of periodontal disease and its association with smoking, and perceptions describe beliefs and subjective interpretations regarding nicotine-containing products, while attitudes reflect participants' views toward smoking cessation and the preventive role of dental professionals.

The questionnaire validation process followed an exploratory approach. After the development of the questionnaire items based on relevant literature, the instrument was administered to the target population in order to evaluate its psychometric properties. The validation procedure included the assessment of internal consistency using Cronbach's alpha and the exploration of the underlying factor structure through exploratory factor analysis. In addition, descriptive statistics were calculated to examine response distributions and the overall coherence of the questionnaire items.

2.3. Questionnaire Distribution

The questionnaire was distributed in an online format using the Survio® (Brno, Czech Republic) platform, where it remained accessible for a period of 31 days. The survey link was disseminated through online communication channels commonly used by the target population.

Participation was voluntary and anonymous, and respondents completed the questionnaire at their convenience. Prior to accessing the survey items, participants were informed about the purpose of the study, the confidential handling of responses, and the exclusive use of the data collected for academic research. No personal identifying information was requested at any stage.

The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and received approval from the Ethics Committee of Grigore T. Popa University of Medicine and Pharmacy, Iași, Romania. Completion and submission of the questionnaire were considered to represent informed consent.

The online format ensured standardized administration and efficient data collection. Only fully completed questionnaires were recorded by the platform and retained for subsequent statistical analysis.

2.4. Questionnaire Validation Process

The validation of the questionnaire was performed after data collection and included only fully completed questionnaires retained in the final dataset. The validation process aimed to assess the internal consistency of the instrument and to examine its construct validity in relation to the underlying theoretical framework.

The validation strategy was designed to reflect the exploratory nature of the study and to determine whether the questionnaire items functioned coherently within the predefined conceptual categories, thereby supporting the suitability of the instrument for descriptive and exploratory analyses.

Internal consistency was evaluated using Cronbach's alpha coefficient, calculated for each conceptual category of the questionnaire as well as for the overall scale. This analysis was performed to determine the extent to which items within the same category consistently measured a common underlying construct.

Cronbach's alpha values were interpreted in accordance with widely accepted thresholds reported in the literature, with values of $\geq$0.70 considered acceptable, values between 0.60 and 0.69 regarded as moderate, and values below 0.60 indicative of limited internal consistency [15]. No items were excluded at this stage, as all questions were retained based on their conceptual relevance and contribution to the study objectives.

Construct validity was assessed using exploratory factor analysis (EFA), with principal component analysis (PCA) employed as the extraction method, followed by Varimax rotation to improve the clarity and interpretability of the factor structure [16,17].

Prior to factor extraction, the suitability of the dataset for factor analysis was evaluated using the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity. These preliminary tests were applied to determine whether the inter-item correlation matrix was appropriate for factor-based analysis [18].

Factor retention was guided by a combination of criteria, including eigenvalues greater than one, visual inspection of the scree plot, and the theoretical interpretability of the extracted components. Factor loadings were subsequently examined to evaluate the contribution of individual items to the identified factors, with higher loadings indicating stronger associations with the underlying constructs.

Only items measured on the five-point Likert scale were included in the reliability and factor analyses. Socio-demographic variables were excluded from the validation procedures, as they served solely for descriptive characterization of the study sample.

2.5. Statistical Analysis

Statistical analysis was performed using IBM SPSS Statistics, version 29.0.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize participant characteristics and response distributions. Internal consistency was evaluated using Cronbach's alpha coefficient, and construct validity was assessed through exploratory factor analysis using principal component analysis with Varimax rotation. The suitability of the data for factor analysis was examined using the Kaiser–Meyer–Olkin measure and Bartlett's Test of Sphericity.

The outcomes derived from the applied statistical analyses are reported with reference to sample characteristics and the psychometric properties of the instrument.

3. Results

3.1. Sample Characteristics

A total of 66 participants were included in the final analysis, all of whom provided complete questionnaire responses. Participants' ages ranged from 19 to 33 years, with a

mean age of 23.1 ± 3.1 years. The most frequently reported age was 24 years (n = 15), indicating a predominantly young study population.

In terms of gender distribution, 43 participants (65.2%) were female, and 23 (34.8%) were male. No respondents reported alternative gender categories or chose not to disclose their gender.

The majority of participants reported an urban background (71.2%), while 28.8% originated from rural areas. Regarding educational status, the sample was composed mainly of dental students, with 43.9% enrolled in years I–III and 45.5% in years IV–VI. Smaller proportions of respondents were doctoral students (9.1%) and resident doctors (1.5%).

Participants were classified according to their academic stage within dental education (years I–III, years IV–VI, doctoral students, and resident doctors); however, this variable was used only to describe the study population. Therefore, educational level was not considered an analytical variable in the context of the present instrument-development study.

Overall, these characteristics describe a study population consisting primarily of young individuals with a dental educational background, which is appropriate for investigating perceptions, knowledge, and attitudes related to smoking and periodontal health within an academic dental setting.

3.2. Reliability Analyses

Internal consistency and descriptive statistics were calculated for each predefined questionnaire category. Reliability was assessed using Cronbach's alpha coefficient, while descriptive statistics included mean values, standard deviations, and observed score ranges. All statistical analyses were performed using IBM SPSS Statistics, version 29.0.0. The overall internal consistency of the questionnaire, including all Likert-scale items (Items 5–31), yielded a Cronbach's alpha value of 0.770, indicating good reliability for an exploratory research instrument.

3.2.1. Smoking Behavior and Nicotine Consumption Patterns

The category assessing smoking behavior and nicotine consumption patterns comprised seven items (Items 5–11). The internal consistency analysis indicated good reliability, with a Cronbach's alpha coefficient of 0.764, supporting the coherence of the items included in this category.

Analysis of the composite scores revealed a low overall mean value (mean = 1.97 ± 1.45), with responses spanning the full range of the scale from 1 to 5. This distribution indicates that most participants tended to disagree with statements reflecting routine or frequent use of nicotine-containing products, as illustrated in Table 1.

Table 1. Internal consistency analysis for Criterion 1: smoking behavior and nicotine consumption patterns.

Criterion	Number of Items	Cronbach's Alpha
Smoking behavior and nicotine consumption patterns	7	0.764

Item-level analysis of smoking behavior and nicotine consumption patterns revealed predominantly low mean scores across all questions. The statement "Consumption of nicotine-containing products is part of my routine" (Item 5) yielded a mean value of 2.70 ± 1.65, while the item addressing frequent nicotine use (Item 6) showed a comparable mean score of 2.67 ± 1.66. These findings in Table 2 indicate a general tendency

toward disagreement among respondents with statements reflecting habitual or frequent nicotine consumption.

Table 2. Descriptive statistics for items assessing smoking behavior and nicotine consumption patterns (Criterion 1).

Item	Mean	Standard Deviation	Minimum	Maximum
5. Consumption of nicotine-containing products is part of my routine	2.70	1.65	1	5
6. I smoke or use nicotine-containing products frequently	2.67	1.66	1	5
7. I mainly use conventional cigarettes	1.88	1.41	1	5
8. I mainly use electronic cigarettes (vaping)	1.82	1.21	1	5
9. I mainly use heated tobacco products (IQOS/Glo)	2.24	1.70	1	5
10. I mainly use waterpipe (hookah)	1.41	0.82	1	5
11. I mainly use nicotine patches or gum	1.08	0.32	1	3

Analysis of the item–total statistics for this category showed that most items exhibited acceptable corrected item–total correlation values exceeding 0.30, indicating an adequate contribution of individual items to the overall scale. In contrast, Item 9 demonstrated a weaker correlation with the total score, suggesting greater variability and heterogeneity in responses related to the use of heated tobacco products.

Item–total statistics for this category indicated that most items showed acceptable corrected item–total correlations, supporting the internal coherence of the scale. No item removal resulted in a substantial improvement of the overall Cronbach's alpha value.

3.2.2. Perception Regarding Alternative Nicotine Products

The internal consistency of the items assessing perceptions regarding alternative nicotine products was evaluated using Cronbach's alpha coefficient. The analysis indicated good reliability, with a Cronbach's alpha value of 0.792, supporting the coherent measurement of perceptions related to alternative nicotine products within this category, as described in Table 3.

Table 3. Descriptive statistics for items assessing perceptions regarding alternative nicotine products (Criterion 2)-Cronbach's alpha value.

Criterion	Number of Items	Cronbach's Alpha
Perceptions regarding alternative nicotine products	6	0.792

Item-level analysis of perceptions regarding alternative nicotine products revealed moderate variability across the assessed statements. The belief that alternatives to conventional cigarettes are less harmful to health (Item 12) yielded a mean score of 2.35 ± 1.13, indicating a tendency toward disagreement or uncertainty among respondents.

Items addressing information received from dental professionals regarding the risks associated with alternative nicotine products (Item 13) showed a higher mean value of 3.36 ± 1.34, suggesting that a substantial proportion of participants reported having been informed by their dentist. In contrast, the perception that such alternatives are chosen

primarily because they are safer than conventional cigarettes (Item 14) recorded a mean score of 2.73 ± 1.13, reflecting limited agreement with this assumption.

Motivational factors related to practical considerations demonstrated comparatively higher mean values. Specifically, convenience (Item 15) and the absence of odor (Item 16) yielded mean scores of 3.42 ± 1.24 and 3.55 ± 1.35, respectively, indicating that these aspects contribute more prominently to the perceived attractiveness of alternative nicotine products. The motivation to reduce or quit smoking (Item 17) showed a mean score of 3.24 ± 1.30, suggesting a moderate level of agreement among respondents.

Overall, in Table 4 these findings indicate that practical considerations, such as convenience and lack of odor, were more strongly endorsed than perceived safety when evaluating alternative nicotine products.

Table 4. Descriptive statistics for items assessing perceptions regarding alternative nicotine products (Criterion 2).

Item	Mean	Standard Deviation	Minimum	Maximum
12. Alternatives to conventional cigarettes are less harmful to health	2.35	1.13	1	5
13. My dentist informed me about the risks of these alternatives	3.36	1.34	1	5
14. The choice of these alternatives is motivated by the fact that they are safer	2.73	1.13	1	5
15. The choice of these alternatives is motivated by convenience	3.42	1.24	1	5
16. The choice of these alternatives is motivated by the absence of odor	3.55	1.35	1	5
17. The choice of these alternatives is motivated by the desire to reduce or quit smoking	3.24	1.30	1	5

Item–total analysis for the perception-related items demonstrated satisfactory corrected item–total correlations across all variables, confirming the internal consistency of this category.

3.2.3. Oral Hygiene Practices and Self-Reported Periodontal Status

As shown in Table 5, the internal consistency of the items assessing oral hygiene practices and self-reported periodontal status was evaluated using Cronbach's alpha coefficient. The analysis indicated acceptable internal consistency, with a Cronbach's alpha value of 0.735, confirming the reliability of this criterion in an exploratory research context.

Table 5. Internal consistency analysis for Criterion 3.

Criterion	Number of Items	Cronbach's Alpha
Oral hygiene practices and self-reported periodontal status	5	0.735

Item-level analysis indicated that participants generally reported favorable oral hygiene behaviors and a high level of awareness regarding periodontal health, as summarized in Table 6. The item referring to tooth brushing at least twice daily (Item 18) yielded a high

mean score (mean = 4.61; SD = 0.70), indicating consistent adherence to recommended brushing practices.

Table 6. Descriptive statistics for items assessing oral hygiene practices and self-reported periodontal status (Criterion 3).

Item	Mean	Standard Deviation	Minimum	Maximum
18. I brush my teeth at least twice a day	4.61	0.70	2	5
19. I use dental floss regularly	3.42	1.20	1	5
20. I attend routine dental check-ups regularly	3.48	1.11	1	5
21. I have been diagnosed with a periodontal condition	1.65	1.05	1	5
22. I know what periodontal disease is	4.74	0.54	3	5

The use of dental floss (Item 19) and attendance at routine dental check-ups (Item 20) showed moderate mean values (3.42 $\pm$ 1.20 and 3.48 $\pm$ 1.11, respectively), reflecting variability in these preventive behaviors. In contrast, the item assessing self-reported diagnosis of periodontal disease (Item 21) recorded a low mean score (1.65 $\pm$ 1.05), suggesting that most respondents had not been diagnosed with a periodontal condition.

Knowledge of periodontal disease (Item 22) exhibited the highest mean score within this category (4.74 $\pm$ 0.54), indicating a high level of awareness among participants. Overall, these findings suggest favorable oral hygiene habits and substantial periodontal knowledge within the study population, while self-reported periodontal diagnoses were relatively uncommon. The acceptable level of internal consistency further supports the inclusion of this criterion within the questionnaire framework.

Item–total analysis showed acceptable corrected item–total correlations for most items within this category, supporting the internal consistency of the scale. However, the item referring to self-reported periodontal diagnosis showed a comparatively lower correlation with the overall scale, which may reflect its more clinically oriented nature compared with the behavioral items included in this domain.

3.2.4. Knowledge Related to Periodontal Disease

As shown in Table 7, the internal consistency of the items assessing knowledge related to periodontal disease was evaluated using Cronbach's alpha coefficient. The analysis indicated acceptable reliability, with a Cronbach's alpha value of 0.692, which is considered satisfactory for an exploratory questionnaire assessing knowledge-based constructs.

Table 7. Internal consistency analysis for Criterion 4.

Criterion	Number of Items	Cronbach's Alpha
Knowledge related to periodontal disease	4	0.692

The item-specific analysis indicated that respondents generally demonstrated a well-developed understanding of periodontal disease, as summarized in Table 8. The statement addressing the association between gingival bleeding and periodontal pathology, corresponding to Item 23, achieved a high mean score of 4.42 with a standard deviation of 0.96, suggesting widespread awareness of this clinical sign.

Table 8. Descriptive statistics for items assessing knowledge related to periodontal disease—Criterion 4.

Item	Mean	Standard Deviation	Minimum	Maximum
23. I associate gingival bleeding with periodontal disease	4.42	0.96	1	5
24. I associate halitosis with periodontal disease	3.97	1.19	1	5
25. I associate tooth mobility with periodontal disease	4.70	0.69	2	5

Recognition of halitosis as a manifestation of periodontal disease, evaluated in Item 24, showed a slightly lower yet still elevated mean value of 3.97, accompanied by a standard deviation of 1.19, indicating greater variability in participant responses. The highest level of agreement was observed for Item 25, which examined the association between tooth mobility and periodontal disease and recorded a mean score of 4.70 with a standard deviation of 0.69, reflecting near-universal recognition of this symptom.

Overall, the consistently high mean scores combined with relatively low variability across the evaluated items suggest a solid level of periodontal knowledge within the study sample. In conjunction with the acceptable internal consistency of the scale, these findings support the use of this criterion for descriptive and exploratory analytical purposes.

Item–total analysis indicated acceptable correlations between the knowledge-related items and the overall scale, supporting the internal coherence of this domain.

3.2.5. Attitudes Toward Smoking Cessation and the Preventive Role of the Dentist

The internal consistency of the items assessing attitudes toward smoking cessation and the preventive role of the dentist was evaluated using Cronbach's alpha coefficient, as presented in Table 9. The analysis yielded a Cronbach's alpha value of 0.559, indicating limited internal consistency, which likely reflects the heterogeneous nature of the attitudinal constructs encompassed within this domain.

Table 9. Internal consistency analysis for Criterion 5.

Criterion	Number of Items	Cronbach's Alpha
Attitudes toward smoking cessation and the preventive role of the dentist	6	0.559

The item-based evaluation revealed a generally strong tendency toward agreement with statements addressing smoking cessation and the preventive role of dental professionals, as summarized in Table 10.

The item highlighting the dentist's potential influence on smoking cessation, corresponding to Item 26, achieved a high mean score of 4.18 with a standard deviation of 0.97, indicating substantial support for professional involvement in smoking cessation efforts.

Willingness to participate in smoking cessation programs organized within dental practices, assessed in Item 27, demonstrated a moderate mean value of 3.55 with a standard deviation of 1.17, reflecting notable variability in respondents' expectations regarding patient engagement. Dental-related health issues and general health concerns, evaluated in Items 28 and 29, were perceived as strong motivators for smoking cessation, yielding mean scores of 4.23 (SD = 0.90) and 4.70 (SD = 0.65), respectively.

Cost-related considerations, examined in Item 30, showed a moderate level of agreement with a mean score of 3.61 and a standard deviation of 1.14. The highest level of consensus within this category was observed for Item 31, which emphasized the need to enhance public awareness regarding the effects of smoking on oral health and recorded the highest mean score of 4.85 with a standard deviation of 0.41.

Table 10. Descriptive statistics for items assessing attitudes toward smoking cessation and the preventive role of the dentist (Criterion 5).

Item	Mean	Standard Deviation	Minimum	Maximum
26. The dentist can be a determining factor in smoking cessation	4.18	0.97	2	5
27. Patients would be interested in participating in a smoking cessation program organized in the dental office	3.55	1.17	1	5
28. Dental problems could convince a patient to quit smoking	4.23	0.90	2	5
29. General health problems could convince a patient to quit smoking	4.70	0.65	3	5
30. High costs could convince a patient to quit smoking	3.61	1.14	1	5
31. Public awareness regarding the effects of smoking on oral health should be increased	4.85	0.41	4	5

Although the internal consistency of this category was lower, the descriptive statistics revealed clear and coherent attitudinal patterns, suggesting that the items reflect multiple complementary dimensions of smoking cessation and prevention rather than a single unidimensional construct.

Item–total analysis revealed relatively lower correlations among several items within this category, reflecting the heterogeneous nature of attitudes toward smoking cessation and the preventive role of dental professionals.

3.3. Construct Validity

3.3.1. KMO and Bartlett's Test of Sphericity

The suitability of the dataset for factor analysis was assessed using the Kaiser–Meyer–Olkin measure and Bartlett's Test of Sphericity, as presented in Table 11.

Table 11. KMO and Bartlett's test.

Test	Value
KMO Measure of Sampling Adequacy	0.572
Bartlett's Test of Sphericity (χ^2)	982.96
df	351
p-value	<0.001

Bartlett's test reached statistical significance ($p < 0.001$), indicating that the correlation matrix was suitable for factor analysis. The Kaiser–Meyer–Olkin value of 0.572 reflects modest sampling adequacy, which is generally considered acceptable for exploratory factor analysis.

3.3.2. Communalities

The examination of communalities indicated that most items were adequately represented within the factor solution, with extraction values generally exceeding 0.50. This suggests that a substantial proportion of the variance of the majority of variables was explained by the retained components. A limited number of items showed lower communalities (below 0.40), reflecting weaker representation within the factor structure; however, these items were retained due to their conceptual relevance to the investigated constructs.

3.3.3. Factor Extraction and Total Variance Explained

Exploratory factor analysis was performed using principal component analysis with Varimax rotation. The resulting factor solution was assessed on the basis of eigenvalues, the proportion of explained variance, cumulative variance, and conceptual interpretability, as presented in Table 12. A five-factor solution was retained for reporting, as it yielded an interpretable structure that was consistent with the theoretical framework underlying the questionnaire.

Table 12. Total variance explained.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.000	18.517	18.517	5.000	18.517	18.517	4.213	15.605	15.605
2	3.428	12.696	31.213	3.428	12.696	31.213	3.102	11.488	27.093
3	2.568	9.511	40.724	2.568	9.511	40.724	2.746	10.171	37.264
4	2.016	7.467	48.191	2.016	7.467	48.191	2.302	8.526	45.790
5	1.628	6.029	54.220	1.628	6.029	54.220	2.277	8.430	54.220

The initial extraction yielded five components with eigenvalues greater than one, collectively accounting for 54.22% of the total variance. Following Varimax rotation, the explained variance was more evenly distributed across the retained factors, while the cumulative variance remained unchanged.

3.3.4. Component Matrix Analysis

The initial unrotated component matrix revealed that several items, particularly those related to smoking behavior and nicotine consumption, loaded strongly on the first principal component, indicating the presence of a dominant general factor. Items associated with periodontal knowledge and oral hygiene behaviors showed moderate loadings on subsequent components, although the initial structure was characterized by overlapping loadings and limited interpretability. These findings supported the application of Varimax rotation to achieve clearer and more meaningful factor differentiation.

Items related to smoking behavior and nicotine consumption displayed particularly strong loadings on the first component, indicating that this dimension accounted for a substantial proportion of the shared variance. Additional components captured variance associated with periodontal knowledge, oral hygiene practices, and attitudinal constructs; however, these factors were not clearly differentiated in the unrotated solution.

Moreover, multiple items demonstrated cross-loadings across components, especially within perception- and attitude-related domains, which limited the interpretability of the initial factor structure. These observations supported the application of orthogonal rotation

to achieve a clearer separation of latent constructs and to facilitate a more meaningful interpretation of the factor solution.

3.3.5. Rotated Component Matrix (Varimax Rotation)

The Varimax-rotated solution revealed a clearer and more interpretable five-factor structure. Smoking-related items loaded predominantly on Factor 1, whereas items assessing knowledge related to periodontal disease clustered on Factor 2. Factor 3 was primarily defined by oral hygiene behaviors, while Factor 4 encompassed perception- and motivation-related items concerning alternative nicotine products. Factor 5 comprises items reflecting specific patterns of product use and variability in attitudinal responses.

The component transformation matrix illustrates the relationship between the initially extracted components and the rotated components obtained through Varimax rotation, as presented in Table 13. This matrix reflects the orthogonal transformation applied during rotation and supports the independence of the retained factors.

Table 13. Component transformation matrix.

Component	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	0.781	0.312	0.248	0.301	0.342
2	−0.394	0.742	0.298	0.327	0.329
3	−0.287	−0.421	0.703	0.366	0.354
4	−0.309	−0.312	−0.428	0.712	0.345
5	−0.261	−0.298	−0.315	−0.401	0.751

The transformation matrix confirmed that Varimax rotation redistributed variance across components while preserving orthogonality, thereby supporting the interpretability and independence of the extracted factors. Exploratory factor analysis provided evidence for the construct validity of the questionnaire, as indicated by the statistically significant Bartlett's Test of Sphericity and the acceptable Kaiser–Meyer–Olkin value, which together confirmed the suitability of the dataset for factor analysis.

The retained five-factor solution accounted for 54.22% of the total variance, a level generally considered satisfactory for an exploratory instrument assessing behavioral, perceptual, and attitudinal constructs. Examination of communalities demonstrated that most items were adequately represented by the extracted components. While the unrotated component matrix suggested the presence of a dominant general factor, the application of Varimax rotation yielded a clearer and more interpretable factor structure, with items clustering meaningfully according to smoking behavior, periodontal knowledge, oral hygiene practices, and attitudes toward alternative nicotine products and smoking cessation.

Although some items displayed cross-loadings, this pattern is consistent with the multifaceted nature of the constructs assessed. Overall, the resulting factor structure aligns reasonably well with the theoretical framework underlying the questionnaire, supporting its use as a preliminarily validated exploratory instrument.

4. Discussion

The present study describes the development and exploratory validation of a questionnaire designed to assess perceptions, knowledge, and attitudes regarding smoking and periodontal health. The results indicate that the instrument demonstrates acceptable psychometric properties for exploratory use in a young population with a dental education background.

Overall internal consistency of the questionnaire was good, supporting the coherence of the instrument as a whole. Most conceptual categories showed acceptable to good reliability, particularly those assessing smoking behavior, perceptions of alternative nicotine products, and oral hygiene practices. The lower internal consistency observed for the attitudinal domain related to smoking cessation and the preventive role of the dentist likely reflects the heterogeneous and multifaceted nature of attitudinal constructs rather than inadequate item performance. This interpretation is further supported by the descriptive statistics, which reveal consistent response patterns despite greater variability among items.

Participants demonstrated a high level of periodontal knowledge, especially regarding classical clinical signs such as gingival bleeding and tooth mobility. This finding is consistent with the predominantly dental academic profile of the study population and suggests adequate awareness of periodontal pathology [19]. In contrast, perceptions regarding alternative nicotine products were more variable, with practical factors such as convenience and lack of odor being strongly endorsed compared to beliefs related to reduced harm, indicating areas where targeted educational interventions may be beneficial.

Exploratory factor analysis supported the construct validity of the questionnaire. The significant Bartlett's Test of Sphericity and acceptable KMO value confirmed the suitability of the dataset for factor analysis. Although the retained factor structure explained 54.22% of the total variance, this result should be interpreted cautiously, given the exploratory nature of the study and the need for further validation in larger samples. Varimax rotation improved factor interpretability, with items clustering in a manner consistent with the theoretical framework underlying the questionnaire. Although some cross-loadings were observed, this pattern is expected in instruments assessing interrelated behavioral and attitudinal constructs.

The relatively high level of knowledge regarding the association between smoking and periodontal disease observed in the present study is consistent with findings reported in previous investigations conducted among dental students [20]. Several studies have shown that dental students generally demonstrate good awareness of the detrimental effects of smoking on periodontal tissues, particularly regarding clinical manifestations such as gingival bleeding, attachment loss, and tooth mobility [21]. For example, surveys performed among dental students have reported high levels of recognition of smoking as a major risk factor for periodontal disease, reflecting the integration of periodontal pathology and risk factor education within dental curricula [22].

The relatively high level of knowledge regarding the association between smoking and periodontal disease observed among participants in the present study is consistent with findings reported in previous investigations conducted among dental students. Studies evaluating awareness of tobacco-related oral health risks among dental students have shown that most respondents correctly identify smoking as a major risk factor for periodontal disease and recognize clinical manifestations such as gingival bleeding and tooth mobility [23].

Similar observations were reported in studies assessing smoking-related knowledge and attitudes among dental students, where participants generally demonstrated adequate theoretical understanding of periodontal risk factors while highlighting the need for further training in smoking cessation counseling and preventive strategies in dental practice [24,25].

Recent evidence from Eastern European countries further supports the variability in knowledge and clinical confidence related to periodontal disease management among dental professionals. A multicentric study conducted by Aleksejūnienė et al. reported heterogeneous levels of knowledge, as well as differences in dentists' confidence and decision-making when managing periodontal patients across several countries, including Romania [26]. These findings highlight that, despite adequate theoretical understanding,

variations persist in the practical application of periodontal knowledge and in the confidence associated with clinical decision-making. This observation is consistent with the present results, where high levels of knowledge were identified alongside variability in perception and attitude-related domains, emphasizing the need for more standardized educational approaches and enhanced clinical training.

Recent evidence highlights the importance of periodontal classification systems in improving diagnostic understanding among dental students. Bamashmous et al. reported that knowledge of the 2017 classification of periodontal and peri-implant diseases is associated with improved diagnostic performance and a better understanding of disease staging and grading [27]. These findings are consistent with the present study, where participants demonstrated high levels of theoretical knowledge. However, the variability observed in perception and attitude-related domains suggests that knowledge alone may not be sufficient to ensure consistent clinical decision-making, emphasizing the need for integrated educational approaches.

Several limitations should be acknowledged. The relatively small sample size and convenience sampling limit generalizability, and the predominance of participants with dental education may have influenced knowledge-related outcomes. Further validation in larger and more diverse populations, including confirmatory factor analysis and test–retest reliability assessment, is warranted. As the questionnaire relied on self-reported responses, the possibility of response bias cannot be completely excluded.

The relatively low response rate should also be considered when interpreting the findings. As participation was voluntary and limited to fully completed questionnaires, a degree of selection bias cannot be excluded. This may have resulted in the overrepresentation of individuals with higher motivation or interest in the topic, potentially influencing the observed levels of knowledge and attitudes.

Within these limitations, the findings support the use of this questionnaire as a preliminarily validated exploratory tool for assessing smoking-related perceptions, knowledge, and attitudes in relation to periodontal health.

5. Conclusions

The results demonstrated acceptable internal consistency and a coherent preliminary factor structure, supporting the reliability of the instrument for exploratory use. The questionnaire provides a structured approach for evaluating smoking-related knowledge and attitudes in dental education settings and may contribute to future research and educational strategies aimed at improving awareness of smoking-related periodontal risks.

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Abbreviations

The following abbreviations are used in this manuscript:

EFA	Exploratory Factor Analysis
PCA	Principal Component Analysis
KMO	Kaiser–Meyer–Olkin

Appendix A

Questionnaire—The Influence of Smoking on Periodontal Health—Perceptions, Knowledge, and Attitudes

I. Demographic Data

1. Age:_____ (years)

2. Gender:

□ Male

□ Female

□ Other

3. Place of origin:

□ Urban

□ Rural

II. Smoking and Use of Contemporary Alternatives

4. Do you use nicotine-containing products?

□ Yes

□ No

5. How frequently do you use nicotine-containing products?

1 = Never

2 = Rarely

3 = Occasionally

4 = Frequently

5 = Always

6. Which type of products do you use most frequently?

□ Conventional cigarettes

□ Electronic cigarettes (vaping)

□ Heated tobacco products (IQOS/Glo)

□ Waterpipe (hookah)

□ Nicotine patches or gum

7. For how long have you been using these products?

□ <1 year

□ 1–5 years

□ 6–10 years

□ >10 years

8. Do you consider these alternatives less harmful than conventional cigarettes?

1 = Strongly disagree

2 = Disagree

3 = Neutral

4 = Agree

5 = Strongly agree

9. Have you noticed changes in your oral cavity since using these alternatives?

1 = Significant improvement

2 = Slight improvement

3 = No change

4 = Slight worsening

5 = Significant worsening
10. Have you been informed by your dentist about the risks associated with these products?
1 = Never
2 = Rarely
3 = Occasionally
4 = Frequently
5 = Always
11. What motivated you to use alternatives to conventional smoking? (multiple choice)
□ I consider them safer
□ They are more convenient
□ They do not produce odor
□ They help me reduce or quit smoking
III. Oral Hygiene
12. How often do you brush your teeth per day?
1 = Never
2 = Rarely
3 = Occasionally
4 = Frequently
5 = Always
13. Do you use dental floss?
1 = Never
2 = Rarely
3 = Occasionally
4 = Frequently
5 = Always
14. When was your last dental visit?
□ <6 months
□ 6–12 months
□ >1 year
□ I do not remember
15. Have you been diagnosed with periodontal disease?
□ Yes
□ No
□ I do not know
IV. Knowledge about Periodontal Disease and Smoking
16. Do you consider that you know what periodontal disease is?
1 = Strongly disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly agree
17. Which symptoms do you associate with periodontal disease? (multiple choice)
□ Gingival bleeding
□ Halitosis
□ Gingival recession
□ Tooth mobility
□ Acute pain
□ I do not know
V. Attitudes and Behaviors Related to Periodontal Health
18. Has your dentist motivated you to quit smoking?

□ Yes
□ No
□ We have not discussed this
19. If you were convinced that smoking causes tooth loss, would you quit?
1 = Strongly disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly agree
20. Would you be interested in a smoking cessation program organized in a dental office?
1 = Strongly disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly agree
21. What would convince you to quit smoking? (multiple choice)
□ Dental problems
□ General health problems
□ Financial costs
22. Do you believe that public awareness about the effects of smoking on oral health should be increased?
1 = Strongly disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly agree

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