

Association of Oral Health Behavior-Related Factors With Periodontal Health and Oral Hygiene

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Abstract

Background: There are a variety of risk factors that can influence the initiation, continuance, and treatment of periodontal diseases.

Objectives: The purpose of this study was to assess the effect of oral health behavior-related factors on the periodontium.

Materials and Methods: A total of 130 participants were included in the study. After completing questionnaires regarding their basic information (age, gender, height, and weight), lifestyle, knowledge, attitude, and oral hygiene behaviors, they were clinically examined for BOP, CPI and SOHI indices. Finally, the data were analyzed using SPSS software with t-tests, ANOVA, and correlation coefficients.

Results: In total, 50.8% of participants had CPI 2, and the average of SOHI was 1.97 ± 0.7 (fair to poor). Among lifestyle variables, smoking and physical activity each had a significant relationship with periodontal health ($P = 0.0001$ and $P = 0.001$, respectively). There were also significant relationships between knowledge, attitude, and CPI and SOHI scores ($P = 0.0001$). BMI also had a significant relationship with CPI ($P = 0.04$) and SOHI ($P = 0.03$) scores.

Conclusions: Oral health behavior-related factors can influence patients' periodontal status and oral hygiene levels.

Keywords: Oral Health, Periodontal Index, Oral Hygiene Index, Lifestyle

1. Background

Periodontal diseases are among the most common oral diseases (1). The prevalence of gingivitis has been estimated as high, even in developed countries (2); without intervention, it can transform into periodontitis, during which attachment loss and bone loss occur (3, 4). The etiology of periodontal diseases, the various appearance, and the lower prevalence of periodontitis compared to gingivitis (5, 6) demonstrates that a variety of factors are responsible for the initiation and progression of the disease. Amongst these factors are smoking, stress, age, the presence of systemic disease, race, ethnicity, and gender (7). The colonization of the gingival crevice with special bacterial genotypes, such as *B. Forsythus* and *P. Gingivalis*, can also affect the severity of periodontal destruction (8).

In addition, other effective factors, including oral health behaviors, have gained increasing attention through the exploration of several studies that have focused on diet, brushing and flossing frequency, dental visit frequencies, and smoking and alcohol consumption; each of these factors could be influenced by other individual factors, such as a person's knowledge, attitudes,

and lifestyle (9-14). There is even a belief that periodontal disease should be considered as a lifestyle disease, and organizations such as the world health organization suggest that prevention programs should focus on tobacco control, diet, and physical activity (2).

Although there is a wide understanding of the risk factors initiating periodontitis, identifying individuals who are especially at risk for the disease's progression is still a major topics for study (15-19). Improving knowledge about how oral health behaviors and related factors can influence periodontal conditions could be helpful in the prevention and enhancement of approaches to periodontal treatment.

2. Objectives

The goal of this study was to analyze the association between oral health behaviors and oral hygiene levels and periodontal status.

3. Materials and Methods

3.1. Study Population

The subjects consisted of patients attending the periodontology ward of Hamadan dentistry school in the years 2013 and 2014. Exclusion criteria were individuals who had systemic diseases or were on any medication, according to their medical history. The study group was selected from a daily roster of patients in a consecutive manner and ultimately included about 130 subjects calculated according to Cochran's formula. We obtained written consent forms from each of them.

3.2. Questionnaire

Before implementing the main study, 10 dental specialists were asked to complete a checklist independently focused on relevancy, clarity, and simplicity, in order to calculate the content validity index (CVI) of the items to be studied. Considering the specialists' suggested corrections to the questionnaire, the mean of S-CVI reached 0.84, which was regarded as acceptable. After determining the validity of the questionnaire, its internal reliability was also determined amongst 30 patients attending the periodontics department. The reliability and internal consistency of the questionnaire were measured using Cronbach's alpha coefficient, which was 0.66.

The questionnaire assessed oral health behaviors and included the following variables:

- 1- Basic information (age, gender, height, and weight)
- 2- Lifestyle
- 3- Knowledge
- 4- Attitude
- 5- Oral hygiene behavior

3.2.1. Lifestyle

Data regarding participants' lifestyles were verified by asking them to report their common health practices according to Belloc and Breslow (20); this includes: smoking and drinking, physical activity, regularity of meal consumption, hours of sleep and physical health status (determined by the body mass index (BMI)). Individuals who answered "often" or "sometimes" for engaging in active sports, swimming, or taking long walks, or those who often did physical exercises, were considered physically active. The BMI was calculated after measuring the height and weight of the participants.

3.2.2. Dental Knowledge

To determine each participant's level of knowledge, we asked patients to choose the correct definition for each of the terms given: dental calculus, dental plaque, dental floss, gingivitis, and fluoride.

3.2.3. Dental Attitude

The participants' attitudes were assessed by asking the opinion of each participant about various oral and dental health items used in the HU-DBI questionnaire (21); their responses were based on a Likert scale.

3.2.4. Oral Hygiene Behaviors

The oral hygiene behavior of each participant was also determined by their answers relating to the frequency of brushing, flossing and attending dental clinics (14).

3.3. Oral Examination

The percentage of sites with bleeding on probing (BOP) was examined as an early sign of periodontal disease using the bleeding point index (Lenox et al., 1973). The periodontal status was determined by reporting the community periodontal index (CPI). The measurements were made at six sites (mesio-buccal, mid-buccal, disto-buccal, disto-lingual, mid-lingual, and mesiolingual) per tooth. Ten teeth were selected for the periodontal examination: two molars in each posterior sextant, and the upper right and lower left central incisors. The simplified oral hygiene index (SOHI) (Greene and Vermilion, 1960) was also used to determine oral hygiene levels.

3.4. Data Analysis

The collected data were analyzed with SPSS V.19 statistical software. The study indices were described using means and standard deviations (SD) and frequency (numbers and percentages). The differences of oral hygiene behavior determinants, according to the CPI and SOHI, were calculated using the chi-square test, and for BOP by ANOVA. In addition, lifestyle determinants and their relationship with SOHI and CPI were assessed by chi-square tests and, accordingly, BOP by T-test. To assess the association between knowledge, attitude, and BMI variables with periodontal status and oral hygiene level, Pearson's correlation coefficients were calculated. The significance level was considered 0.05.

4. Results

One hundred thirty participants, 62 males and 68 females, were included in the study, and all completed the questionnaires (response rate = 100%). The minimum of age of the participants was 15, and the maximum was 59, with an average of 33.23 ± 10.32 . The average recorded weight was $71.33 \text{ kg} \pm 11.63$, with the minimum weight of 48 kg and maximum of 95 kg. The mean height recorded was $169.62 \text{ cm} \pm 8.35$, with a minimum of 152 cm and maximum of 187 cm. The mean BMI was 24.65 ± 2.54 and ranged from 17.85 to 30.44.

The mean recorded value of BOP was $27.86 \pm 12.94\%$, Calculus SOHI 0.39 ± 0.38 , Debris SOHI 0.8 ± 0.43 , and the mean of SOHI was recorded at 1.91 ± 0.7 .

According to the results regarding knowledge, the rates of correct answers to terms provided were: 89.2% for dental floss, 85.4% for the importance of fluoride in oral health, 58.5% for dental calculus, 52.3% for dental plaque and 47.7% for gingivitis, respectively.

The association between lifestyle and periodontal status and oral hygiene levels are shown in Table 1. According to the results, not smoking and engaging in physical activity had significant relationships with CPI ($P = 0.0001$). Not smoking and engaging in physical activity also had a significant relationship with SOHI ($P = 0.0001$ and $P = 0.006$, respectively). The participants who did not drink although not significantly but showed better periodontal status and oral hygiene levels (Table 1).

Table 2 shows the association of oral hygiene behaviors with periodontal status and oral hygiene levels. There was a significant relationship between oral hygiene behaviors and SOHI. Most of the participants who had good oral hygiene levels brushed their teeth at least once daily (100%), used dental floss almost every day (85%), and had regular dental checkups (100%). In contrast, most of the participants who had poor oral hygiene level did not brush (46.2%) and did not floss (96.2%) ($P = 0.0001$).

In addition, oral hygiene behaviors were significantly associated with the CPI. Most of those with a CPI score of "1" brushed their teeth twice a day (60%), whereas those with a CPI score of "4" did not brush their teeth (52.6%) ($P = 0.0001$). Further, most of the participants who had periodontal pockets (CPI III, IV) did not use dental floss (85% and 100%, respectively) (Table 2).

The distribution of oral health attitudes among respondents is shown in Figure 1. According to the results, the percentage of participants compliant with the phrases given was 90% for attending dental clinic when experiencing pain, 84.6% for seeking dental treatment as needed, 82.3% for noting the importance of the correct method of brushing and the significance of learning it, 61.5% for noting the importance of the time spent brushing to ensure its effectiveness, 43.1% for the capability of flossing to aid in creating dental spaces, and 70% for noting the importance of probable color changes in teeth and gingiva.

Table 3 shows the correlations between knowledge, attitude, and BMI with periodontal status and oral hygiene levels. As demonstrated in the table, there were reversed associations between knowledge and attitude of patients and their CPI, SOHI, and BOP scores ($P = 0.0001$). However, direct associations were observed between BMI and CPI ($P = 0.04$), SOHI ($P = 0.03$) scores.

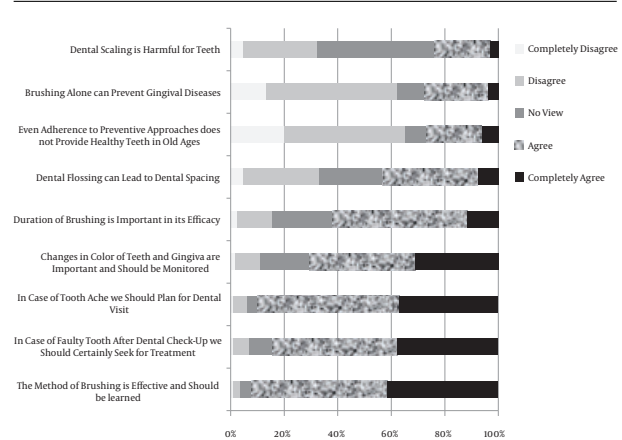


Figure 1. Distribution of Oral Health Attitudes Among Respondents

5. Discussion

The aim of this cross-sectional study was to analyze the association of oral health behaviors with oral hygiene levels and periodontal conditions. Because of the role of oral health behaviors on plaque accumulation, and hence periodontal health, knowing the determinants of oral health behaviors could be helpful in the prevention of disease and the promotion of treatment approaches.

In the study done by Payne and Locker, they noted that the optimal oral health behaviors are annual dental checkups, brushing teeth at least once daily, daily use of dental floss, not snacking between meals, and not eating foods that have been shown to lead to dental caries more than once daily (22).

According to our study's findings regarding oral hygiene behaviors, most of the participants (86.2%) visited dental clinics only when having a dental problem. Also, most of them (87.7%) brushed their teeth at least once a day, but most (58.5%) did not floss every day.

Regarding lifestyles, 73.8% of the participants were non-smokers, 92.3% did not consume alcohol, 68.5% engaged in regular physical activity, 92.3% got an adequate amount of sleep, 71.5% ate breakfast every day, and 60.8% refrained from snacking between meals.

Considering the CPI results, the scores, recorded in descending order, were: CPI 2 (50.8%), CPI 3 (40.8%), and CPI 4 (14.6%). On the other hand, all the three oral hygiene behaviors (dental visits, brushing, and flossing) were significantly associated with the CPI ($P < 0.05$) (Table 2). Participants with the CPI 1 had significantly higher rates of brushing and flossing frequency; they brushed their teeth twice daily and flossed almost every day. On the other hand, those with CPI 3 did not use dental floss and brushed their

Table 1. Lifestyle Determinants and Their Relationship with SOHI, CPI, and BOP Indices

	Smoking		Drinking Alcohol		Physical Activity		Sufficient Sleep Hours		Breakfast		Snacks Between Meals	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Frequency (%)	26.2	73.8	7.7	92.3	68.5	31.5	92.3	7.7	71.5	28.5	60.8	39.2
SOHI (%)												
Good	0	100	5	95	90	10	100	0	85	15	55	45
Fair	26.9	73.1	7.5	92.5	68.7	31.3	91	9	64.2	35.8	62.1	38.8
Poor	63.2	36.8	10.5	89.5	42.1	57.9	84.2	15.8	63.2	36.8	63.2	36.8
P value	0.0001 ^a		0.75		0.006 ^a		0.17		0.19		0.85	
CPI (%)												
I	0	100	0	100	100	0	100	0	80	20	80	20
II	10.6	89.4	10.6	89.4	80.3	19.7	95.5	4.5	80.3	19.7	62.1	37.9
III	35	65	0	100	60	40	87.5	12.5	65.5	35	47.5	52.5
IV	68.4	31.6	15.8	84.2	36.8	63.2	89.5	10.5	52.6	47.4	78.9	21.1
P value	0.0001 ^a		0.06		0.001 ^a		0.37		0.07		0.09	
BOP (Mean ± SD)	34.81 ± 12.8	25.4 ± 12.13	30.22 ± 13.48	27.66 ± 12.93	26.14 ± 12.83	31.6 ± 12.53	26.99 ± 12.82	38.35 ± 9.79	26.56 ± 12.63	31.13 ± 13.31	28.42 ± 12.51	27 ± 13.67
P value	0.0001		0.55		0.02 ^b		0.007		0.07		0.54	

^aValues are expressed as P < 0.01.^bValues are expressed as P < 0.05.**Table 2.** Oral Hygiene Behaviors and Their Relationship with SOHI, CPI, and BOP Indices

	Dental Visits				Tooth Brushing Daily Frequency				Dental Floss Use	
	Regular Checkups	Visit on Pain	Never	Thrice	Twice	Once	Never	Almost Every Day	Never	
Frequency N (%)	7 (5.4)	112 (86.2)	9 (6.9)	0 (0)	19 (14.6)	95 (73.1)	16 (12.13)	54 (41.5)	76 (58.5)	
SOHI N (%)										
Good	4 (20)	16 (80)	0 (0)	0 (0)	7 (35)	13 (65)	0 (0)	17 (85)	3 (15)	
Fair	3 (15)	77 (93.9)	2 (2.4)	0 (0)	11 (13.1)	69 (82.1)	4 (4.8)	36 (42.9)	48 (57.1)	
Poor	0 (0)	21 (73.1)	7 (26.9)	0 (0)	1 (3.8)	13 (50)	12 (46.2)	1 (3.8)	25 (96.2)	
P value	0.0001 ^a				0.0001 ^a		0.0001 ^a			
CPI N (%)										
I	1 (20)	4 (80)	0 (0)	0 (0)	3 (60)	2 (40)	0 (0)	3 (60)	2 (40)	
II	6 (9.1)	59 (89.4)	1 (1.5)	0 (0)	13 (19.7)	51 (77.3)	2 (3)	45 (68.2)	21 (31.8)	
III	0 (0)	37 (97.4)	1 (2.6)	0 (0)	3 (7.5)	33 (82.5)	4 (10)	6 (15)	34 (85)	
IV	0 (0)	12 (63.2)	7 (36.8)	0 (0)	0 (0)	9 (47.4)	10 (52.6)	0 (0)	19 (100)	
P value	0.0001 ^a				0.0001 ^a		0.0001 ^a			
BOP (Mean ± SD)	17.25 ± 9.67	27 ± 12.07	45.79 ± 11.6	0 ± 0	19.24 ± 9.95	27.55 ± 12.08	39.94 ± 12.5	20.83 ± 9.37	32.86 ± 12.85	
P value	0.001 ^a				0.001 ^a		0.001 ^a			

^aValues are expressed as P < 0.01.

teeth only once per day. Those with the CPI 4 group did not floss or brush at all.

According to our results, the mean of SOHI was 1.91 + 0.7 (fair to poor). Considering that 87.7% of the participants brushed their teeth at least once a day, it can be suggested that brushing alone is not effective for oral hygiene maintenance. Likewise, other studies have shown that the use of other dental devices, such as dental floss, can remove dental plaque more efficiently than brushing alone (23). In our study, 58.5% of the participants did not use dental floss.

Parentetically, the results of our study showed that all

participants with a good oral hygiene level (100%) brushed their teeth at least once daily and had regular dental check-ups (Table 2). The study by Vadiakas et al. also showed that the frequency of teeth brushing is strongly related to oral hygiene levels, and those who brushed more frequently also had significantly lower DI-S scores (24). The positive effect of using dental floss, as mentioned earlier, should also be considered, as most of the participants in our study with good oral hygiene levels also used dental floss almost every day.

We must note that one of our study's limitations is that

Table 3. Correlations Between Knowledge, Attitude, and BMI with Periodontal Status and Oral Hygiene Levels

Variables	Correlation Coefficient	P Value
Knowledge and CPI	-0.56	0.0001 ^a
Knowledge and OHI	-0.55	0.0001 ^a
Knowledge and BOP	-0.49	0.0001 ^a
Attitude and CPI	-0.56	0.0001 ^a
Attitude and OHI	-0.54	0.0001 ^a
Attitude and BOP	-0.51	0.0001 ^a
BMI and CPI	0.17	0.04 ^b
BMI and OHI	0.18	0.03 ^b

^aValues are expressed as $P < 0.01$.^bValues are expressed as $P < 0.05$.

the information regarding the frequency of brushing was collected via self-reported questionnaires. The study by Corbet et al., which investigated the periodontal status of an Asian and Oceania population, mentioned that, despite people's declarations of daily hygiene behaviors, their oral hygiene condition was far from optimal (25).

According to our results, smoking and physical activity were significantly associated with the SOHI, CPI, and BOP indices (Table 1). Those who did not smoke and engaged in regular physical activity had lower CPI and BOP scores and better oral hygiene levels. In addition, adequate sleep hours had a significant relationship with BOP.

It has been shown that smoking, physical activity and other lifestyle determinants are influential on both general human health and oral health. Therefore, the efficacy of brushing on oral health could be achievable in conjunction with lifestyle choices (9, 26). Rajala et al.'s study demonstrated that the frequencies of smoking, drinking, and physical activity are significantly related to oral hygiene behaviors (27). In addition, Belloc et al. mentioned that this relationship could be independent from age, gender, and socio-economic status (20). For example older people with better lifestyle approaches could have higher oral hygiene levels despite their age.

According to our results regarding attitude, the percentage of participants' agreement with the phrases given was 90% for attending dental clinics when facing a problem, 84.6% for receiving dental treatment as needed, 82.3% for noting the importance of the correct method of brushing and the significance of learning it, 61.5% for noting the importance of the time spent brushing as it relates to effectiveness, 43.1% for acknowledging the capability of flossing to create dental spaces, and 70% for noting the importance of probable color changes in teeth and gingiva (Figure 1).

In contrast, most of the participants did not agree that brushing alone could prevent a person from getting gingival diseases (62.3%) or that preventive approaches are incapable of maintaining healthy teeth into old age (65.4%). In addition, 43.8% of the participants had no comment on the harmful effects of scaling on the teeth (Figure 1). Regarding their attitude results, most of the participants knew of the importance of learning the correct method for brushing and, considering that most of them did not use dental floss, they were still aware of the concept of creating dental spaces via flossing. It seems that proper information regarding oral hygiene devices and the benefits of dental scaling are lacking, so as to clear the probable ambiguity that some people have and to improve their oral hygiene levels.

Our results showed that attitude and knowledge were significantly associated with CPI, SOHI, and BOP ($P < 0.05$) (Table 3). Those with higher levels of attitude had significantly better periodontal condition (CPI) and oral hygiene levels (SOHI) and lower BOP values. According to our results regarding knowledge, the rate of correct answers defining the terms provided were, respectively, 89.2% for dental floss, 85.4% for the importance of fluoride in oral health, 58.5% for dental calculus, 52.3% for dental plaque, and 47.7% for gingivitis. The participants who had higher numbers of correct answers had significantly better periodontal status (CPI) and oral hygiene levels (SOHI), and lower BOP. Freeman et al. and Astrom et al. also studied the association of knowledge with oral health. Their results showed that knowledge is an important prerequisite for oral hygiene maintenance. However, this was only a weak association, and they suggested that factors other than knowledge could be involved in oral hygiene behavior changes (28, 29). The results of our study showed that a person's BMI was significantly related to CPI and SOHI (Table 3). Those with lower BMI values had better periodontal and oral hygiene conditions. In Chaffe et al.'s 2010 study, the relationship between obesity and periodontal disease was reviewed, and they concluded that the mean of clinical attachment loss is higher in obese people, and that the mean BMI is higher among periodontal patients. For this reason, they concluded that the risk of periodontal disease increases as BMI increases (30). The reason for these findings, according to Pischon et al., could be the secretion of inflammatory cytokines and hormones from adipose tissues, which that are common elements in both the pathobiology of obesity and inflammation as periodontal disease (31).

In summary, among the factors determining oral health behavior, lifestyle, and smoking and physical activity, in particular, had a significant relationship with periodontal health and oral hygiene levels. Other than tooth

brushing, flossing and dental visits, the factors that had significant relationships with periodontal health and oral hygiene were verified as knowledge, attitude, and BMI.

5.1. Conclusion

Oral health behavior-related factors can influence periodontal status and oral hygiene levels. When treating periodontal patients, factors other than bacterial plaque, such as attitude, lifestyle and knowledge, should also be considered and evaluated in order to improve patients' periodontal status and motivate patients to pursue more suitable oral hygiene behaviors.

Footnotes

Authors' Contribution: Sepideh Seyedzadeh Sabounchi, contributed to the conception and design of the study, the definition of intellectual content, supervision of the study conduct and interpretation of data, and the drafting of the manuscript; Parviz Torkzaban, contributed to the conception and design of study, the definition of its intellectual content, supervision of the study conduct, interpretation of the data and drafting of the manuscript; Reza Ahmadi, contributed to the literature review, design, collection and interpretation of data and drafting the manuscript; Shabnam Seyedzadeh Sabounchi, contributed in the literature review, conception and statistical analysis of data, their interpretation and preparation, and editing and reviewing the manuscript.

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