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Prevalence of periodontal diseases (gingivitis and periodontitis) based on gingival health indices in 35-70-year-old patients referred to Rafsanjan Cohort Center, Iran, in 2019

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Original Article

Abstract

BACKGROUND AND AIM: Periodontal disease is considered to be a remarkable factor affecting the quality of life and systemic and oral health by causing various symptoms for patients. The objective of this research was the evaluation of periodontal status and its related factors including age, gender, educational level, oral hygiene, and diabetes mellitus (DM) in people aged 35-70 years in cohort population of Rafsanjan, Iran.

METHODS: In this cross-sectional study, 7855 patients aged 35-70 years who referred to Rafsanjan Cohort Center in 2019 were selected through systemic sampling and were examined according to their gingival health indices such as bleeding on probing (BOP), periodontal pocket depth, and clinical attachment loss (CAL). Data were then analyzed by SPSS software using chi-square test and independent t-test. P-value less than 0.05 was set as significant level.

RESULTS: All three gingival health indices were higher in people in older age category significantly (P = 0.0001). BOP index was significantly higher in women (P = 0.0001); the other two indices were also more in women, although insignificantly. By education level increase, BOP, pocket depth, and CAL decreased (P = 0.0001, P = 0.0650, and P = 0.0001, respectively). Moreover, brushing decreased all indices although this decline was just significant for BOP and pocket depth (P = 0.0380 and P = 0.0001, respectively). Concerning DM, no significant difference was observed between diabetics and non-diabetics in CAL (P = 08910) and pocket depth (P = 0.3240). However, people with DM had significantly higher BOP (P = 0.0001).

CONCLUSION: Periodontal diseases were more likely in women with older age and lower educational level who had poorer oral hygiene. People with DM had higher BOP but CAL and periodontal pocket were not different between diabetics and non-diabetics.

KEYWORDS: Diabetes Mellitus; Gingival Bleeding; Periodontal Attachment Loss; Periodontal Pocket

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Periodontal disease is the most common oral condition of both developed and developing countries which affects about 20%-50% of human population.[1,2] Gingivitis, a major class of periodontal disease, is the inflammation of the gum initiated by dental plaque.[3,4] When gingivitis is left untreated, it progresses and leads to periodontitis that results in supporting structure of the tooth

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destruction.[5] The first two signs of gingivitis are increased amount of gingival crevicular fluid (GCF) and gingival bleeding on probing (BOP) and what differentiates it from periodontitis is the presence of loss of attachment in periodontitis.[6,7] Different methods are used for diagnosing periodontal disease such as BOP, radiographs, probe depth, and loss of attachment.[8] According to the World Health Organization (WHO), Community Periodontal Index (CPI) criteria which is the examination of all teeth for gingival bleeding, periodontal pockets, and loss of attachment can be used.[9]

In preceding studies, numerous factors have been indicated to be associated with periodontal problems including genetic predisposing, education level, smoking, and cardiovascular, respiratory, and metabolic diseases.[10-16] Regarding the genetic disposing, Michalowicz et al. estimated that genetic factors were responsible for about half of the variance in periodontal disease.[17] Liccardo et al. showed that periodontal disease acted as a risk factor for diabetes mellitus (DM) and cardiovascular disease (CVD). On the other hand, DM can act as a risk factor for chronic gingivitis and periodontitis.[18,19]

Among all associated factors, dental plaque whose accumulation is a result of poor oral hygiene is known to have an important role in periodontal disease.[20] Moreover, periodontal disease risk is enhanced by aging; this is not due to the increase in disease at older ages, but due to the cumulative progression of the disease over time. It also causes biological changes that limit organ function, thereby increasing the likelihood of periodontal disease.[21,22]

In developing countries such as Iran, not a lot of researches have been done on the prevalence of periodontal disease and its associated factors; therefore, the necessity of rigorous studies with standard principles is felt in our country. Regarding the high prevalence of periodontal disease and the fact that it affects not only the supporting tissues of teeth but also several body organs, early detection, prevention, and treatment can help early diagnosis of related systemic problems. The aim of this study was to assess the gingival health indices of 35-70-year-old people and their related factors and also compare them in diabetic and non-diabetic individuals. Obtaining this information can provide the necessary planning to slow the exacerbation of periodontal disease and sometimes prevent it.

Methods

In this cross-sectional study, 7855 patients aged 35-70 years who referred to Rafsanjan Cohort Center, Iran, in 2019, were selected through systemic sampling. Each patient who referred to Cohort Center was given a Persian Cohort Identification (PCID) code in order to be identified by number not real name and filled a consent form for further researches. Demographic data were recorded and among recorded questionnaires, information about having DM was selected for the study and then all patients were examined for gingival health indices including BOP, clinical attachment loss (CAL), and pocket depth. Inclusion criteria included being able to answer questionnaire questions, being 35-70 years old, and living in Rafsanjan. Exclusion criteria were unwillingness to take part in the research and being edentulous.

To record gingival indices, examination was performed by a trained dentist on a dental unit using disposable dental mirror and Williams probe (Michigan "o" probe williams coded, Hu-Friedy, USA).

For assessing BOP index, gentle probing was performed on four sites of each tooth and after 30-60 seconds, the presence or absence of bleeding was recorded. BOP index for each person is the ratio of bleeding points to all points. BOP is one of the earliest signs of gingival inflammation that precedes established gingivitis and its absence is an excellent negative predictor of future attachment loss.[23]

For measuring CAL, around the teeth was

completely probed and the distance between depth of pocket and cemento-enamel junction (CEJ) was recorded.[23] Since there is no specific methodology for periodontitis, some suggest definition of case as a person with CAL.[24] Just plaque-induced CAL was recorded in this study.

For measuring the pocket depth, which is the vertical distance from the free gingival margin to which a probe penetrates into a pocket, probe was moved parallel to axis of teeth along gingival margin and the deepest entrance points of the probe in six sides (mesial, middle, and distal of buccal and lingual surfaces) were recorded.[25] Individuals with more than 2 millimeters (in buccal surfaces of all teeth and proximal surfaces of anterior teeth) or 3 millimeters (in proximal surfaces of posterior teeth) pocket depth were considered to have periodontitis (which means having CAL).[23] Just real pockets were counted in this study.

These three indices (BOP, pocket depth, and CAL) were evaluated based on age, gender, DM, education level, and toothbrushing. The data were then analyzed by SPSS software (version 20, IBM Corporation, Armonk, NY, USA). Comparison between frequency of these three indices with other variables was analyzed by chi-square test. We performed a logistic regression analysis by adjusting important variables in order to assess the association of BOP, pocket depth, and CAL with the independent variables. The adjusted odds ratios (ORs) with 95% confidence interval (CI) were estimated. Values less than 0.05 were considered as significant levels.

Results

In this study, gingival health indices including BOP, pocket depth, and CAL were studied in 7855 people aged 35-70 years with a mean age of 52.82 ± 9.60 years of which, 4143 were women and 3712 were men.

According to table 1, 4493 (57.2%) were BOP positive which means that had at least gingivitis. 1375 (17.5%) had periodontal pocket, and in general, 4132 (52.6%) had periodontitis (CAL).

Table 1. Frequency of bleeding on probing (BOP), periodontal pocket, and clinical attachment loss (CAL) in 35-70-year-olds in Rafsanjan, Iran

Index	Presence or absence of problem		
	+ [n (%)]	- [n (%)]	Total [n (%)]
BOP	4493 (57.2)	3362 (42.8)	7855 (100)
Periodontal pocket	1375 (17.5)	6480 (82.5)	7855 (100)
CAL	4132 (52.6)	3723 (47.4)	7855 (100)

BOP: Bleeding on probing; CAL: Clinical attachment loss

According to table 2, based on chi-square test, no significant difference existed between genders in depth of pocket and CAL ($P > 0.05$), but BOP index was significantly more in women ($P < 0.05$).

In this study, patients were divided into two age categories of 35-50 and 50-70 years according to the mean age of the population. Table 3 indicates that all three indices were significantly higher in group aged 50-70 years ($P < 0.05$).

Table 4 shows that according to the chi-square test, with the exception of periodontal pocket, the other two indices were significantly higher in people with higher educational level ($P < 0.05$).

Table 2. Frequency of bleeding on probing (BOP), periodontal pocket, and clinical attachment loss (CAL) according to gender

Index		Gender			P
		Men [n (%)]	Women [n (%)]	Total [n (%)]	
BOP	+	2066 (49.4)	2120 (50.6)	4186 (100)	0.0001
	-	1385 (43.1)	1829 (56.9)	3214 (100)	
Periodontal pocket	+	627 (46.5)	722 (53.5)	1349 (100)	0.8990
	-	2824 (46.7)	3227 (53.3)	6051 (100)	
CAL	+	1804 (46.1)	2114 (53.9)	3918 (100)	0.2790
	-	1647 (47.3)	1835 (52.7)	3482 (100)	

BOP: Bleeding on probing; CAL: Clinical attachment loss

Table 3. Frequency of bleeding on probing (BOP), periodontal pocket, and clinical attachment loss (CAL) according to age

Index		Age (year)			P
		35-50 [n (%)]	50-70 [n (%)]	Total [n (%)]	
BOP	+	2219 (49.7)	2247 (50.3)	4466 (100)	0.0001
	-	1214 (36.9)	2079 (63.1)	3293 (100)	
Periodontal pocket	+	678 (47.7)	744 (52.3)	1422 (100)	0.0001
	-	2783 (43.9)	3554 (56.1)	6337 (100)	
CAL	+	2029 (48.8)	2128 (51.2)	4157 (100)	0.0001
	-	1432 (39.8)	2170 (60.2)	3602 (100)	

BOP: Bleeding on probing; CAL: Clinical attachment loss

Table 4. Frequency of bleeding on probing (BOP), periodontal pocket, and clinical attachment loss (CAL) according to brushing

Index		Education level			P
		+	-	Total	
BOP	+	2112 (46.7)	2413 (53.3)	4525 (100)	0.0380
	-	1632 (49.0)	1697 (51.0)	3330 (100)	
Periodontal pocket	+	619 (42.7)	829 (48.8)	1448 (100)	0.0001
	-	3126 (48.8)	3281 (51.2)	6407 (100)	
CAL	+	2000 (47.5)	2213 (52.5)	4213 (100)	0.6960
	-	1745 (47.9)	1897 (52.1)	3642 (100)	

BOP: Bleeding on probing; CAL: Clinical attachment loss
Data are presented as n (%).

Table 5 offers that no significant difference existed between people who brushed their teeth and those who did not in CAL (P = 0.696), but BOP and periodontal pocket depth were significantly higher in those who did not brush their teeth (P < 0.05).

Table 6 shows that all indices were significantly higher in diabetics compared to non-diabetic individuals (P < 0.05).

By adjusting the important variables (age, gender, literacy level, toothbrushing, and being diabetic) with BOP, CAL, and pocket depth using logistic regression test, some of the significant results were as follows (Tables 7-9):

Table 6. Frequency of bleeding on probing (BOP), periodontal pocket, and clinical attachment loss (CAL) according to being diabetic

Index		DM			P
		+	-	Total	
BOP	+	873 (22.9)	2941 (77.1)	3814 (100)	0.0001
	-	535 (18.1)	2411 (81.9)	2944 (100)	
Periodontal pocket	+	269 (22.1)	947 (77.9)	1216 (100)	0.0001
	-	1139 (20.5)	4405 (79.5)	5544 (100)	
CAL	+	683 (19.1)	2890 (80.9)	3573 (100)	0.0001
	-	725 (22.7)	2462 (77.3)	3187 (100)	

DM: Diabetes mellitus; BOP: Bleeding on probing; CAL: Clinical attachment loss
Data are presented as n (%).

Toothbrushing variable in CAL was significant statistically (P < 0.001) and odds of (CAL) in the group that did not brush their teeth was 0.17 times more than the group that did. Table 8 shows the variables in logistic regression test.

Table 5. Frequency of bleeding on probing (BOP), periodontal pocket, and clinical attachment loss (CAL) according to education level

Index		Brushing			P
		Secondary level [n (%)]	University education [n (%)]	Total [n (%)]	
BOP	+	3426 (82.0)	754 (18.0)	4180 (100)	0.0001
	-	2274 (85.6)	463 (14.4)	3211 (100)	
Periodontal pocket	+	1123 (83.5)	222 (16.5)	1345 (100)	0.9680
	-	5051 (83.5)	995 (16.5)	6046 (100)	
CAL	+	3222 (82.4)	690 (17.6)	3912 (100)	0.0040
	-	2952 (84.9)	527 (17.6)	3479 (100)	

BOP: Bleeding on probing; CAL: Clinical attachment loss

Table 7. Effective variables in bleeding on probing (BOP) in logistic regression test

Study variables	Coefficient	SE	Wald	df	P	OR	95% CI	
							Lower	Upper
Literacy level*	0.158	0.072	0.646	1	0.422	1.170	0.920	1.221
Age	-0.028	0.003	82.954	1	< 0.001	0.972	0.967	0.978
Constant	2.106	0.276	58.257	1	< 0.001	8.216	-	-

*University/secondary level

SE: Standard error; OR: Odds ratio; CI: Confidence interval; df: Degree of freedom

Effective variables in pocket depth consisted of toothbrushing variable which was significant statistically (P < 0.001) and odds of pocket depth in the group who did not brush their teeth was 0.64 times more than the other group. Regarding diabetic/non-diabetic variable (P = 0.05), odds of pocket depth in the diabetic group was 0.11 times more than non-diabetic group. Table 9 shows the variables in logistic regression test.

Discussion

Periodontal disease is common in human and different factors are related to it. The objective of this study was to assess gingival health indices and some influential factors such as age, gender, educational level, oral hygiene, and DM. In the present study, 57.2% and 52.6% of the population had gingivitis and periodontitis, respectively.

The results of this research with a mean age of 52.82 ± 9.60 showed that BOP, periodontal pocket depth, and CAL were more in women than men although no significant difference existed in BOP between men and women. The results were in line with those of Mascarenhas et al. Generally, sex hormones affect the incidence and development of periodontal problems. Increased levels of estrogen and progesterone can lead to increased levels of inflammatory cytokines; moreover, periodontal diseases in women occur at lower levels of inflammatory cytokines; therefore, women get these diseases earlier than men.[26]

According to our study, with ageing, the rate of BOP, pocket depth, and CAL significantly increased, which was consistent with all reviewed studies.[13,27,28] Due to the cumulative effect of diseases with age, as well as the biological changes that occur over time, the likelihood of periodontal disease increases.[29]

This study showed that CAL and BOP were significantly lower in university graduates compared to people with secondary educational level. However, the index of periodontal pocket was not significantly different. The results were in agreement with the study of Shetty et al.[11] and Roy et al.[12] This difference can be ascribed to more stable attitude towards oral hygiene in people with higher level of education.

Using a toothbrush prevents the accumulation of nutrients needed by the bacteria, thus preventing the progression of periodontal disease. Even with other predisposing factors, hygiene alone can significantly prevent the disease to exacerbate. In our study, people who brushed their teeth had lower BOP, periodontal pocket, and CAL; this result was consistent with the study of Forner et al.[30] and Niskanen et al.[31]

Table 8. Effective variables in bleeding on probing (BOP) in logistic regression test

Study variables		Coefficient	SE	Wald	df	P	OR	95% CI	
								Lower	Upper
Step 1[a]	Toothbrush*	0.160	0.054	8.837	1	0.003	1.173	1.056	1.304
	Age	-0.026	0.003	84.382	1	< 0.001	0.974	0.969	0.980
	DM**	0.043	0.043	1.007	1	0.316	1.044	0.960	1.135
	Constant	1.248	0.186	44.853	1	< 0.001	3.484		

a: Variable(s) entered on step 1: Toothbrush, Age, Diabetes

*Brushing/not brushing; **Non-diabetic/diabetic

SE: Standard error; OR: Odds ratio; CI: Confidence interval; df: Degree of freedom; DM: Diabetes mellitus

Table 9. Effective variables in pocket depth in logistic regression test

Study variables		Coefficient	SE	Wald	df	P	OR	95% CI	
								Lower	Upper
Step 1[a]	Toothbrush[*]	0.495	0.066	55.597	1	< 0.001	1.640	1.440	1.868
	DM[**]	-0.104	0.053	3.835	1	0.050	0.901	0.812	1.000
	Age	-0.017	0.004	23.126	1	< 0.001	0.983	0.976	0.990
	Constant	-1.068	0.233	21.024	1	< 0.001	0.344		

a: Variable(s) entered on step 1: Toothbrush, Diabetes, Age
[*]Brushing/not brushing; [**]Non-diabetic/diabetic
SE: Standard error; OR: Odds ratio; CI: Confidence interval; df: Degree of freedom; DM: Diabetes mellitus

Regarding DM, diabetic individuals had remarkably higher BOP which suggests the microvascular changes in response to higher level of glucose that makes the tissue prone to bleeding while probing. These results were similar to the study done by Roy et al.[32] What Botero et al.[33] found in their studies was also consistent with our findings in terms of the higher CAL in people with DM. Jindal et al. concluded that people with DM with poor glycemic control had increased CAL in comparison with those with better glycemic control.[34]

The limitations of our study include the cross-sectional nature of it which fails us to report the causal associations and also lack of information about the exact amount of blood glucose based on fasting blood sugar (FBS) in blood tests and the exact dose of nicotine each person receives. Strength of our study was the great sample size of it. Further longitudinal studies are needed to evaluate periodontal status based on blood glucose level.

Conclusion

According to the results of the present study, periodontal disease is more likely in women, older age group, people who brush less, and people with lower education level. No significant difference was seen in different groups of DM although BOP index was significantly higher in people with DM.

Conflict of Interests

Authors have no conflict of interest.

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