

IMPACT OF SOCIOECONOMIC STATUS AND ORAL HYGIENE PRACTICE ON PERIODONTAL HEALTH OF EGYPTIAN ADULTS A HOSPITAL BASED CROSS-SECTIONAL STUDY

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ABSTRACT

Background: The influence of socioeconomic factors on health outcomes is well-established. Although periodontal disease is linked to cardiovascular diseases and diabetes, there have been no studies focusing on socioeconomic disparities in periodontal disease among Egyptian adults. This study aimed to evaluate how socioeconomic status and oral hygiene practices affect the periodontal health of Egyptian adults.

Methods: A periodontal assessment was conducted on 456 adults who visited outpatient and paid treatment clinics at the Faculty of Dentistry, Cairo University. Data on socio-demographics, brushing techniques, brushing frequency, and periodontal health knowledge were collected through a questionnaire.

Results: This observational, cross-sectional study included 456 adults (267 women and 189 men). The prevalence of periodontal disease was found to be 89.1%, with 54.6% of participants classified as having stage I periodontitis and 22.8% in stage II. Only 8.6% and 3.1% progressed to stages III and IV, respectively. Factors such as age, low socioeconomic status, infrequent brushing, and being male were positively correlated with the presence of periodontal disease. Conversely, being female, brushing frequently, and utilizing effective brushing techniques showed a negative correlation with the disease. Participants without periodontitis and those with stage I exhibited a better understanding of the causes of periodontal disease, the importance of regular dental visits, and the factors contributing to gum recession.

Conclusions: The study highlighted that age, socioeconomic status, brushing frequency, and the use of proper brushing techniques are significant factors impacting the prevalence and severity of periodontal diseases.

KEYWORDS: periodontal health, oral hygiene practice, Periodontitis, Socioeconomic status

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INTRODUCTION

Periodontal disease is an inflammation triggered by bacteria that infects the tissues that support the teeth, leading to the loss of connective tissue and the reduction of alveolar bone ^[1,2]. This condition adversely affects public health, individual quality of life, and overall general health ^[3-5]. The initial Global Burden of Disease (GBD) study in 1990 reported a 6.05% incidence of periodontal disease. More recent GBD data from 2015 indicated that the global prevalence had risen to 7.53%, affecting 538 million people of all ages. This prevalence has continued to climb. Gender-wise, the prevalence rates stand at 7.05% for women and 8.02% for men. Among individuals aged 30 to 34, the prevalence for both sexes was recorded at 6.73%. The rise in global life expectancy could be a factor in the growing incidence of periodontal disease ^[6].

Treating periodontal disease is costly and significantly impacts the quality of life, particularly in low-income communities. Socioeconomic disadvantages, including low income, limited education, and minority racial or ethnic status, contribute to a higher risk of periodontal disease across all age groups. Adolescents' color/race, school type, and location have all been linked to the prevalence of harmful periodontal conditions ^[7]. Risk factors like smoking, alcohol consumption, poor diet, stress, and inadequate dental hygiene further exacerbate the likelihood of developing periodontal disease ^[8-10].

Health conditions can occur in different numbers in different populations, and genetic and biological predispositions can only partially account for these differences. The circumstances in which people are born, grow, work, live, and age are what induce these variations. The social determinants of health are a group of variables that include items like family income, maternal and infant development, housing and sanitation, access to health and educational resources, employment conditions, and others ^[11]. Also, there was a global correlation between a

number of socioeconomic and demographic factors and periodontitis ^[12].

Good oral hygiene (OH) reduces the risk of periodontitis compared to moderate and poor OH, showing a notable dose-response relationship between oral hygiene practices and the occurrence of periodontitis. Regular dental visits and frequent brushing can decrease the risk of periodontitis by 32% and 34%, respectively. Oral hygiene may have a more significant impact on periodontal health compared to other risk factors like obesity and diabetes. Particularly, infrequent tooth brushing is strongly associated with severe periodontitis ^[13].

The study aimed to evaluate the influence of socioeconomic status and oral hygiene practices on the periodontal health of Egyptian adults, with participants recruited from the outpatient clinic and the paid treatment clinics at the Faculty of Dentistry, Cairo University.

MATERIALS AND METHODS

Study design and participants

This study was conducted in compliance with the regulations set forth by the Ethics Committee of the Faculty of Dentistry, Cairo University, Egypt (approval: 3420). Patients who met the inclusion and exclusion criteria were recruited over a three-month period, from November 1, 2020, to January 21, 2021. The target sample population was drawn from the outpatient clinics and the paid treatment clinics at the Faculty of Dentistry, Cairo University. The study's objectives were thoroughly explained to all participants, who then signed a written informed consent form in Arabic, indicating their full understanding and agreement to participate in the research. The study's inclusion criteria specified that participants needed to be between 18 and 70 years old, of any gender, and of Egyptian ethnicity. The criteria for exclusion from the study comprised patients who cannot open their mouths or are

undergoing intermaxillary fixation, individuals with psychiatric issues or those intoxicated by alcohol or drugs, pregnant patients, individuals receiving orthodontic care, and patients who have undergone periodontal treatment in the six months leading up to the study.

Sample size calculation

This power analysis used prevalence of periodontitis in subjects who didn't have university degree as the primary outcome. Based upon the results of^[14], the prevalence of periodontitis =25.6%. Using alpha (α) level of (5%), acceptable margin of error = 4% and an estimated total number of patients attending Diagnostic Center at the Faculty of Oral and Dental Medicine = 223200 patients per year; the minimum estimated sample size was 456 subjects. Sample size calculation was performed using Epi Info 7.2.2.2^[14].

Data collection and grouping

Data was gathered using a structured questionnaire, which was filled out for each patient by the examiner (AM). This questionnaire was chosen based on the guidelines established by Jegede et al^[15]. The questionnaire featured a section dedicated to collecting demographic details such as age, sex, occupation, address, and level of education, which the examiner filled out during the clinic visit. Socioeconomic status was evaluated using a validated scale tailored for health research in Egypt,

categorizing participants into low, moderate, and high socioeconomic subgroups. Several questions addressed periodontal practices, focusing on self-care activities like tooth brushing, flossing, and mouth rinsing over the past year, as well as scaling in the previous five years. Furthermore, knowledge of periodontal health was examined through questions about the main causes of periodontal diseases and the significance of dental visits for their prevention^[16].

Oral examination

The examiner (AM) performed a clinical assessment to determine the periodontal status in accordance with the latest classification of periodontal diseases, established in 2018, to reach the study's primary outcomes^[17]. A periodontal examination was conducted for all participants using the Community Periodontal Index (CPI) to evaluate their periodontal condition. The dentition was split into sextants, and the highest code representing the most severe periodontal condition around each of the 10 indexed teeth was documented.^[18] Each tooth was probed with a light force not exceeding 25 grams at six points: mesiobuccal, midbuccal, distobuccal, mesiolingual, midlingual and distolingual (**table 1**). To determine the stage of periodontitis, measurements of pocket depth (PD) and clinical attachment level (CAL) were conducted utilizing a Williams periodontal probe. Periodontitis was classified into four distinct stages (**Table 2**).

TABLE (1) CPITN/CPI score

CPITN/CPI score	Periodontal status (CPITN)	CAL criteria (CPI)
0	Healthy periodontium	Loss of attachment 0-3mm, CEJ not visible
1	Bleeding observed by probing/spontaneous	Loss of attachment 4-5mm
2	Calculus felt by probe, entire black area is visible	Loss of attachment 6-8mm
3	Pocket depth 4-5mm, gingival margin on the black band	Loss of attachment 9-11mm
4	Pocket depth>6mm, entire black band is invisible	Loss of attachment 12mm or more
X	Excluded sextant	Excluded sextant

TABLE (2) Classification of periodontal diseases into four stages

Periodontitis stage	Stage I	Stage II	Stage III	Stage IV
Interdental CAL at site of greatest loss	1–2 mm	3–4 mm	5>mm	5>mm
Severity Radiographic bone loss	Coronal third (<15%)	Coronal third (15% to 33%)	Extending to middle or apical third of the root	
Severity Tooth loss	No tooth loss due to periodontitis		Tooth loss due to periodontitis of £4 teeth	Tooth loss due to periodontitis of 5> teeth
Complexity Local	- Maximum probing depth 4<mm. - Mostly horizontal bone loss	- Maximum probing depth ≤5mm.7 - Mostly horizontal bone loss	In addition to Stage II complexity: - Probing depth ³ 6mm. - Vertical bone loss ³ 3mm. - Furcation involvement class II or III - Moderate ridge defect	In addition to Stage III complexity: Need for complex rehabilitation due to: - Masticatory dysfunction - Secondary occlusal trauma (tooth mobility degree ≥2) - Severe ridge defect - Bite collapse, drifting, flaring - Less than 20 remaining teeth (10 opposing pairs)

CAL, clinical attachment level

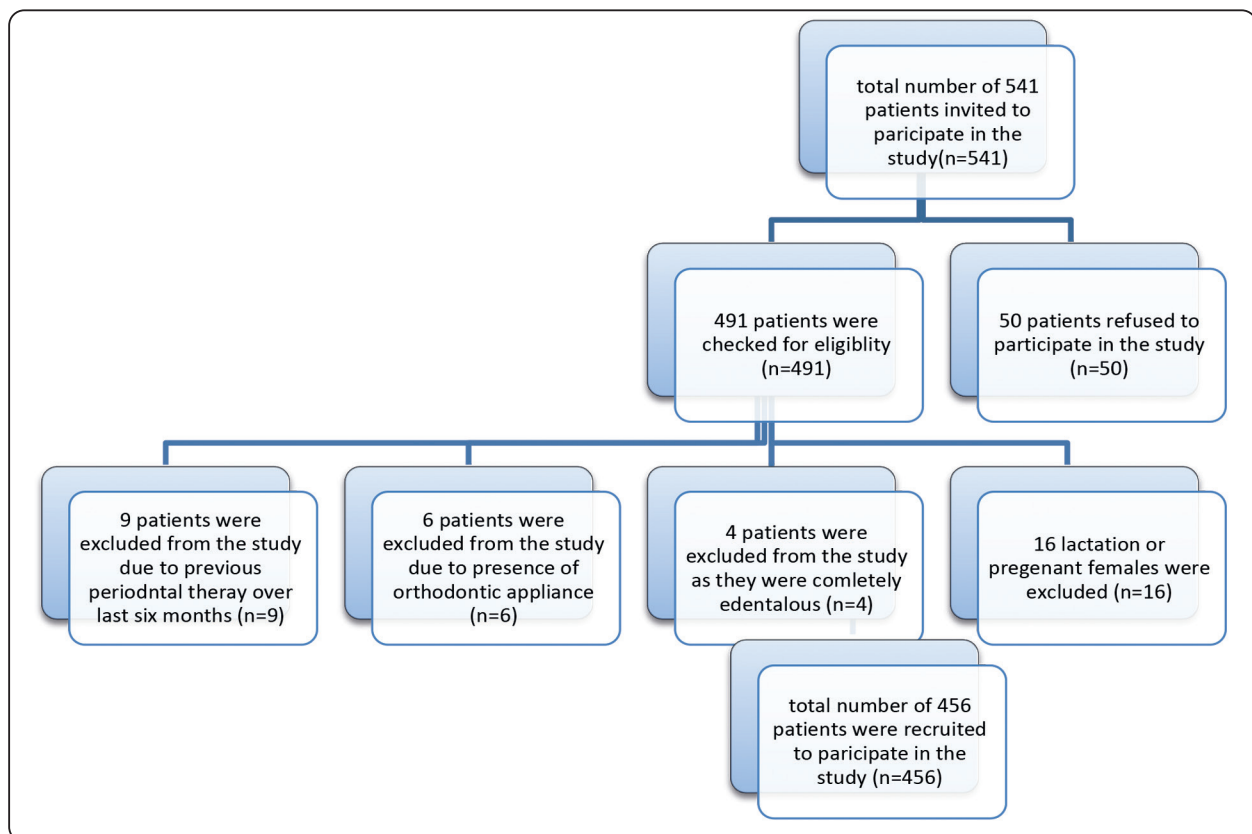


Fig. (1) Flow chart of patient selection

Statistical analysis Data

Summary of the statistical analysis was presented as frequency and percentages for categorical outcomes and as mean with standard deviation for numerical outcomes. Chi-square test was used to compare categorical data. Numerical data was checked for normality using Kolmogorov-Smirnov and Shapiro-Wilk tests. For parametric outcomes, one-way ANOVA test was used with Tukey post-hoc test for pairwise comparisons. All testes were two-tailed and significance level was set at level of $P \leq 0.05$. Statistical analysis was performed using IBM (NY: IBM Corp. USA) Statistical Package for Social Sciences SPSS for Windows version 26.

RESULTS

Population profile

Figure 1 illustrates the number of participants at each phase of the study. Table 3 provides a detailed breakdown of the number and percentage of patients across various categories. The findings revealed that 25.7% of participants reported brushing their teeth twice a day, while 19.1% indicated that they do not engage in any tooth brushing. The prevalence of dental calculus was identified at 61%. Concerning the observed periodontal stages, 50 participants, accounting for 11% of the total sample, were found to be free of periodontitis. Among the cases of periodontitis, stage I constituted the largest proportion, with 249 participants (54.6%), followed by stage II, which included 104 participants (22.8%). Additionally, 39 participants (8.6%) were diagnosed with stage III periodontitis, and 14 participants (3.1%) were classified as stage IV.

Correlation between periodontal health status and different risk variables

As it is revealed in Table 4, the mean age was the lowest in participants with no periodontitis (29.92 ± 8.98 years), while the highest mean age was observed in stage IV periodontitis (46.43 ± 11.67 years).

There was a statistically significant comparison between different periodontitis categories regarding age ($p > 0.001$).

Participants without periodontitis were comprised mainly of female participants (68% females) and stage I (63.9% females), while stage III and IV composed mainly of male participants (64.1% and 71% males respectively). There was a statistically significant association between gender distribution in different periodontitis statuses ($p = 0.001$).

Regarding SES and education levels, participants with no periodontitis, the majority were belonging to high education level (80%), while in stage III and IV, the highest portion was reported in low educational level (46.2% and 42.9% of corresponding group participants respectively). There was a statistically significant differences in socio-economic status among different periodontal status categories ($p < 0.001$).

Participants with high socio-economic background constituted the largest portion of participants with no periodontitis (58%) while in stage III and IV, most participants belonged to the low socio-economic background (56.4% and 64.3% of corresponding periodontal status respectively). The distribution of socio-economic status differed significantly between different periodontal status categories ($p < 0.001$).

In the present study, most participants with no periodontitis reported the use of tooth brushing twice daily (72%) and for stage I; largest portion included participants who used the brush once daily (45.5%). In contrast, majority of participants in stage III and IV did not convey any usage of tooth brush (76.9% and 85.7% respectively). Brushing frequency was significantly associated with periodontal status ($p < 0.001$).

Also, Majority of participants without periodontitis reported using the roll technique (66.0%), while all participants in stage III and 92.9% of stage IV

participants were not aware of the brushing technique. The technique of brushing showed a statistically significant differences between different periodontal status ($p < 0.001$).

Regarding the correlation between the participants` dental knowledge and periodontal status, 96% of participants with no periodontitis correctly identified dental plaque as the major

cause, while only 20.5% participants in stage III and 21.4% of stage IV correctly identified dental plaque. The responses to question regarding the perceived causes of periodontal diseases were significantly different among different periodontal status groups ($p < 0.001$). All participants without periodontitis identified diabetes as the cause, while 46.2% of stage III participants and 21.4% of stage IV participants correctly identified it.

TABLE (3) Categorical variables: a descriptive analysis (N=456)

Parameter		Categories, number (%)			
1. Age	Mean	95% ci		Median	
	37.11	25.94-38.27		35	
2. Gender	Male				Females
	189 (41.4)				267 (58.6)
3. Socioeconomic status	Low	Middle		High	
4. Level of education	108 (23.7)	231 (50.7)		117 (25.7)	
	Low	Middle		High	
	62 (13.6)	172 (37.7)		222 (48.7)	
5. Periodontal health practice					
Brushing frequency	No brushing	Infrequent	Once daily	Twice daily	Three times a day
	87 (19.1)	98 (21.5)	142 (31.1)	117 (25.7)	12 (2.6)
Brushing techniques	Horizontal	Vertical	Roll	Not aware	
	83 (18.2)	149 (32.7)	64 (14.0)	160 (35.1)	
Interdental aids	Not aware	Sometimes		Yes	
	323 (70.8)	97(21.3)		36 (7.9)	
6. Calculus	Yes				No
	278 (61.0)				178 (39.0)
7. Periodontal status	Health	Stage I	Stage II	Stage III	Stage IV
	50 (11.0)	249(54.6)	104 (22.8)	39 (8.6)	14 (3.1)
8. Knowledge					
Q1: cause of gum disease	Dental plaque	Dental caries	Food debris		
	257 (56.4)	182 (39.9)	17 (3.7)		
Q2: cause of gum disease	Diabetes	Hypertension	Rheumatism		
		50 (11.0)	16 (3.5)		
Q3 : regular visits protect	Yes				No
	314 (68.9)				142 (31.1)

TABLE (4) Association between periodontal health status and different risk variables (N=456).

Parameters and categories		Number (%)					Correlation
		Periodontitis					p-value
		Health	Stage I	Stage II	Stage III	Stage IV	
1. Age	18–70 years	50 (11.0)	249 (54.6)	104 (22.8)	39 (8.6)	14 (3.0)	<0.001*
2. Gender	Males	16 (32.0)	90 (36.1)	48 (46.2)	25 (64.1)	10 (71.4)	0.001
	Females	34 (58.0)	159 (63.9)	56 (53.8)	14 (53.9)	4 (28.6)	
3. Socioeconomic status	Low	3 (6.0)	41 (16.5)	33 (31.7)	22 (56.4)	9 (64.3)	<0.001
	Middle	18 (37.0)	131 (52.6)	60 (57.7)	17 (43.6)	5 (35.7)	
	High	29 (58.0)	77 (30.9)	11 (10.6)	0 0	0 0	
4. Level of education	Low	1 (2.0)	15 (6.0)	22 (21.2)	18 (46.2)	6 (42.9)	<0.001
	Middle	9 (18.0)	101 (40.6)	47 (45.2)	11 (28.2)	4 (28.6)	
	High	40 (80.0)	133 (53.4)	35 (33.7)	10 (25.6)	4 (28.6)	
5. Periodontal practice							
Brushing frequency	No brushing	0 0	14 (5.6)	31 (29.8)	30 (76.9)	12 (85.7)	<0.001
	Infrequent	0 0	41 (16.5)	48 (46.2)	7 (17.9)	2 (14.3)	
	Once daily	9 (18.0)	113 (45.4)	18 (17.3)	2 (5.1)	0 0	
	Twice daily	36 (72.0)	75 (30.1)	6 (5.8)	0 0	0 0	
	Three times	5 (10.0)	6 (2.4)	1 (1.0)	0 0	0 0	
Brushing technique	Horizontal	0 0	56 (22.5)	26 (25.0)	0 0	1 (7.1)	<0.001
	Vertical	17 (34.0)	121 (48.6)	11 (10.6)	0 0	0 0	
	Roll	33 (66.0)	31 (12.4)	0 0	0 0	0 0	
	Not aware	0 0	41 (16.5)	67 (64.4)	39 (100)	13 (92.9)	
Interdental aids	Not aware	4 (8.0)	163 (65.5)	103 (99.0)	39 (100)	14 (100)	<0.001
	Sometimes	13 (26.0)	83 (33.3)	1 (1.0)	0 0	0 0	
	Yes	33 (66.0)	3 (1.2)	0 0	0 0	0 0	
6. Knowledge							
Q1: cause of gum disease	Dental plaque	48 (96.0)	167 (67.1)	31 (29.8)	8 (20.5)	3 (21.4)	<0.001
	Dental caries	2 (4.0)	82 (32.9)	71 (68.3)	22 (56.4)	5 (35.7)	
	Food debris	0 0	0 0	2 (1.9)	9 (23.1)	6 (42.9)	
Q2 :cause of gum recession	Diabetes	50 (100)	233 (93.6)	86 (82.7)	18 (46.2)	3 (21.4)	<0.001
	Hypertension	0 0	13 (5.2)	17 (16.3)	16 (41.0)	4 (28.6)	
	Rheumatism	0 0	3 (1.2)	1 (1.0)	5 (12.8)	7 (50.0)	
Q3 regular visits protect	Yes	49 (98.0)	207 (83.1)	49 (47.1)	7 (17.9)	2 (14.3)	<0.001
	No	1 (2.0)	42 (16.9)	55 (52.9)	32 (82.1)	12 (85.7)	

DISCUSSION

Assessing the prevalence of periodontal health is difficult due to issues like misclassification of cases and the number of teeth and sites that need evaluation. In our research, all participants underwent a periodontal assessment using the community periodontal index (CPI) to evaluate their periodontal health status^[18].

We implemented a novel classification framework that divides periodontitis into stages based on severity and the challenges of managing local risk factors. This framework is beneficial because it provides valuable insights into the severity, diagnosis, pathogenesis, and treatment needs of periodontal diseases, making it more effective than alternative classification methods^[19].

Our findings indicated that the prevalence of periodontal disease varied by gender. The majority of participants without periodontitis were female (68%), and most individuals in stage I were also female (63.9%). In contrast, stages III and IV showed a predominance of male participants, aligning with previous research that indicated poorer periodontal health among males^[20].

Age was another significant factor associated with periodontal conditions in our study. Participants without periodontitis had a mean age of 29.92 ± 8.98 years, whereas those with stage IV periodontitis had the highest mean age at 46.43 ± 11.67 years. This finding is consistent with earlier studies that established a positive correlation between age and periodontal disease^[21].

Moreover, our study revealed significant differences in socio-economic status across various periodontal status categories. Participants from higher socio-economic backgrounds made up the largest group among those without periodontitis (58%), while the majority of those in stages III and IV came from lower socio-economic backgrounds (56.4% and 64.3%, respectively). These results align

with previous research involving a cross-sectional study of 416 individuals aged 30-60, which found a positive relationship between socio-economic status and periodontal health, specifically, that severe forms of periodontitis were more prevalent in lower socio-economic groups, indicating higher levels of calculus and periodontal pockets compared to their higher socio-economic counterparts^[22]. However, our results contradicted another study that was conducted over a year with 298 patients at the periodontics clinic of the University College Hospital in Ibadan, Nigeria^[23].

Poor oral hygiene is also a recognized risk factor for periodontal disease, as it contributes to plaque and calculus buildup, leading to gingivitis and potentially progressing to periodontitis if not treated^[24]. Our study supports this, as most participants without periodontitis reported brushing their teeth twice daily (72%), while the majority in stage I brushed once daily (45.5%). In contrast, a significant number of participants in stages III and IV reported not brushing their teeth at all (76.9% and 85.7%,

The frequency of brushing teeth was significantly linked to periodontal health ($p < 0.001$). Among participants without periodontitis, a substantial majority reported brushing twice a day (72%), while those in stage I periodontitis were mostly found to brush once daily (45.5%). Conversely, the majority of participants in stage III and stage IV did not engage in tooth brushing at all (76.9% and 85.7%, respectively). This aligns with the findings of a systematic review by^[25] which identified a clear link between frequent tooth brushing and the more severe stages of periodontal disease.

Concerning the significance of doctor visits for prophylaxis across various periodontal status groups ($p < 0.001$), an overwhelming 98% of participants without periodontitis answered affirmatively, whereas only 17.9% and 14.3% of those in the stage III and stage IV groups, respectively, responded with "yes.". This aligns with findings from a study

by [26] which identified the lack of a dental check-up within the past three years as a possible risk factor for significant attachment loss.

The results of this study revealed that, to some extent, periodontal health practices and knowledge are adequate, especially among participants from higher socioeconomic backgrounds. Consequently, there is a need to establish preventive and educational programs to enhance individuals' awareness and understanding of oral and periodontal care. In this context, dentists play a crucial role in adequately informing their patients and aiding in the development of preventive oral health initiatives and awareness efforts.

Although the current research analyzed the association between periodontal status and various risk factors, we recommend conducting more extensive cross-sectional studies. Furthermore, we suggest developing educational health programs and guidelines. Oral and dental policymakers should pay greater attention to socioeconomic disparities and design targeted policies for various socioeconomic status groups.

In summary, there was a positive correlation between periodontal disease and factors such as age, low socioeconomic status, infrequent brushing, and male gender. Conversely, a negative correlation was observed in females, brushing frequency, and the use of appropriate brushing techniques. Adults without periodontitis and those with stage I periodontitis demonstrated greater awareness of the causes of periodontal disease, the significance of regular dental visits, and the factors leading to gum recession. Adhering to a comprehensive oral hygiene regimen and scheduling consistent dental examinations can significantly reduce the likelihood of developing periodontal diseases while simultaneously improving overall oral health.

Conflict of interest:

The authors declare no conflict of interest.

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Ethics:

This protocol was approved by the ethical committee of the faculty of dentistry-Cairo university on: 30th of April 2020, approval number:3-4-20.

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