Original Research Article

A case-control study on risk predictors associated with periodontitis in systemically healthy patients; a Regression Analysis

ABSTRACT

Aim: This case-control study was conducted to analyze the association of periodontitis with risk predictors i.e. age, gender, education status, brushing habits and past dental visits in systemically healthy patients.

Materials and Methods: The study included total of 1097 systemically healthy, non-tobacco using patients with age ≥ 18 years that reported to periodontology department from year 2018. The demographic details and dental care pattern of the patients were extracted from the records of periodontology department, and their frequencies were formulated. The association of five study variables i.e. age, gender, education status, brushing habits and past dental visits was assessed using forward step-wise logistic regression analysis.

Results: Total of 471(42.9%) patients were diagnosed with periodontitis. Higher frequency of periodontitis was observed in patients who were male and ≥ 50 years of age. Regression analysis showed that the subjects with < 50 years of age, ≥ 12 years of education, regular brushing habits and regular past dental visits had greater odds of being safe from periodontitis.

Conclusion: Since the population chosen for this research was systemically healthy, non-tobacco using individuals, a high prevalence (42.9%) of periodontitis was observed indicating the need to analyze the factors other than systemic conditions contributing in prevalence of periodontitis. Furthermore, a positive association between study variables and periodontitis was observed in this research, which will help the clinicians in prediction of periodontitis in systemically healthy, non-tobacco using individuals.

Keywords: Periodontitis, Education, Dental care, Case-control study

1. INTRODUCTION

Periodontitis is a disease of the supporting tissues of the teeth, characterized as irreversible polymicrobial breakdown of host homeostasis resulting in a progressive destruction of periodontium supporting the teeth.[1]

The prevalence of periodontal diseases has been reported in many studies worldwide which vary depending upon the criteria being used and the diversity in population being studied.[2] Data from epidemiological studies reported in 2016 reveal that Periodontitis is the sixth most prevalent chronic condition in the world.[3] As reported by Marcenes W et al. in 2013, globally about 11% of individuals, are suffering with severe type of periodontitis.[4] In Pakistan, data from 2003-2012 reported that 18% of the population suffers from periodontitis out of which 31% suffered from advanced periodontitis.[5]

Periodontitis is a chronic condition influenced by numerous systemic, local and environmental factors. Adverse effects of factors like, tobacco, diabetes, and stress on periodontal health have been reported widely all around the world and their link is well established.[6] There is also fair evidence in literature indicating that lower education level results in inadequate oral health

knowledge, insufficient dental preventive behaviors, and less usage of oral health services in general population.[7] A higher prevalence of periodontitis among subjects with low education level and increased age has also been reported.[8] Inadequate oral hygiene practice is a significant factor that plays a role on plaque accumulation and development of periodontal disease.[9] Regular dental visits are also considered important for the success in prevention and control of periodontitis, therefore maintaining a functional dentition.[10] The literature also enlightens the importance of age, gender, education status, brushing habits and past dental visits in prevention and control of periodontitis, however none of the researches have been conducted in systemically healthy individuals solely.[6-10] Although the relationship between periodontitis and the factors under consideration for present study have already been established worldwide, but their role in influencing incidence in systemically healthy patients is still unclear. Considering that these factors alone play a pivotal role in periodontal disease, they have been masked in previous studies conducted. This study focuses on prevalence of periodontitis in non-tobacco using, systemically healthy patients and includes the risk indicators which may be linked with this irreversible disease so that prediction and prevention of periodontitis is possible in these patients as well.

2. MATERIALS AND METHODS

This case-control study was conducted in periodontology department of Islamabad Medical and Dental College (dental section). After approval from institutional review board, record files of 4,490 patients were retrieved from periodontology department for the year 2018 from 1st January to 31st December. The data were present in the form of standard questionnaire based history sheets along with sheets elaborating intra-oral and extra-oral clinical findings, radiographic findings as well as full mouth periodontal charting sheets including measurements of 6-point periodontal pocket depth, gingival recession, furcation involvement, mobility and attachment level. These records were obtained after taking informed consent from the patient that these will be used for future researches.

From the records patient's selection was done according to the inclusion criteria and exclusion criteria i.e. ≥ 18 years old, systemically healthy and non-tobacco using patients were included and systemically unhealthy or patients taking any medications were excluded as shown in flow chart (fig 1). Data were extracted from the records by exploring dental history, education status, oral hygiene practice and past dental visits.

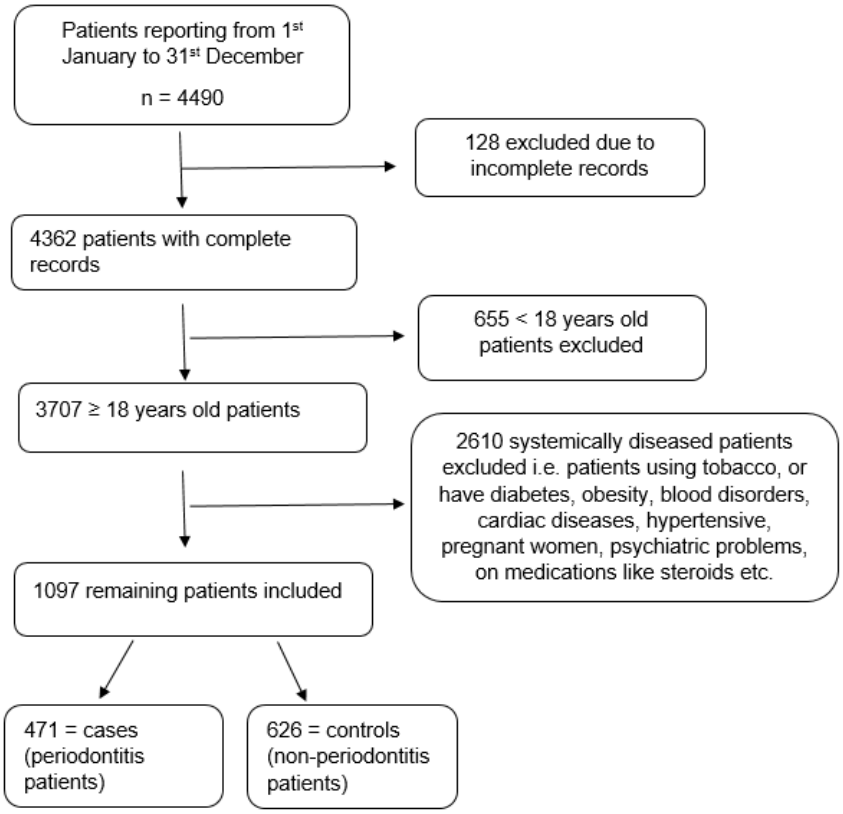

Fig 1: Flow chart of patient selection.

Patients diagnosed with periodontitis were chosen as case and the non-periodontitis were considered as controls. The past medical and dental history, periodontal examination records and radiographic findings were evaluated, and patients were diagnosed with periodontitis accordingly on the criteria of periodontal classification proposed in 2017.[11] The five study variables (exposures) chosen were age, gender education status, brushing habits and past dental history. Age of the patients and education status were divided into two groups (18-49 years and ≥ 50) [12], (years of education < 12 and years of education ≥ 12) [9] respectively. Brushing habits of the patients was divided into three groups (regular, irregular and never brushers).[13] Past dental visits of patients were divided into three groups i.e. those who visit once in a year (regular attendee), those who visit only when they encounter a dental problem (irregular dental attendee) and those who never visited a dentist before.[14]

2.1 Statistical Assessment

The data were entered in the statistical package for social sciences (SPSS) software version 22. The periodontal diagnosis of the patients was established, and the frequencies were formulated. Sub analysis of patients suffering from periodontitis was done by using cross-tabulation to formulate percentages of periodontitis within individual variable. The effects of study variables on periodontitis were studied by applying forward step-wise logistic regression analysis. The dependent variable (outcome) was periodontitis with the reference category, absence of periodontitis. The independent variables (predictors) were age, gender, patient education level, brushing habits and past dental visits the corresponding reference categories as 50-80, female, < 12, never brushed, and never visited. Hosmer-Lameshow goodness of fit test was applied to determine whether the model adequately describes the data. Wald's statistics and odd's ratio (with 95% confidence interval limit)

were used to assess the significance and contribution of individual variables. A p-value of < 0.05 was considered statistically significant for all the variables.

3. RESULTS

This retrospective case-control study included 1097 patients. Socio-demographic details with dental care pattern of the total patients are given in table 1 which shows that more than half (86.1%) of the patients were 18-49 years old females. Furthermore, more than half of the patients had < 12 years of education (66.3%), brushed regularly (78.9%) and visited the dental clinic for the first time (45.1%).

TABLE 1. Demographic data and dental care pattern of patients

VARIABLES	FREQUENCIES IN TOTAL n= 1097	FREQUENCIES IN CASES n=471	FREQUENCIES IN CONTROLS n=626
AGE			
18-49	944	363	581
≥ 50	153	108	45
GENDER			
Male	468	218	250
Female	629	253	376
EDUCATION			
< 12 years of education	727	357	370
≥ 12 years of education	370	114	256
BRUSHING HABITS			
Never brushed before	127	91	36
Irregular	104	75	29
Regular	866	305	561
PAST DENTAL VISITS			
Never visited before	495	212	283
Irregular	468	239	229
Regular	134	20	114

Forward step-wise logistic regression analysis was used for the prediction of periodontitis in systemically healthy patients. The classification table indicates, how well the model predicts that periodontitis is absent or present in a patient (table 2). The model correctly classifies 224 patients who had periodontitis but misclassified 247 (it correctly classified 47.6% of the patients). The model also correctly classified 537 patients who had no periodontitis but misclassified 89 (it correctly classified 85.8% of the patients). The overall accuracy of the classification is 69.4% (224+537/1097)

after the inclusion of all predictors in the model. It implies that the model is in fact correct about two out of three times (table 2).

TABLE 2. Classification table after inclusion of predictors

Observed		Predicted			
		Periodontitis		Total	Percentage
		Present	Absent		
Periodontitis	Present	224	247	471	47.60%
	Absent	89	537	626	85.80%
Overall percentage				1097	69.40%

Hosmer-Lameshow goodness of fit test indicates that model adequately fits the data (p-value 0.804). For the assessment of the model residuals, the scatter plot of Cook's distance is constructed (fig 2). It is clearly shown that the mean Cook's distance in less than one and for most of the patients, it is less than 0.02 which is the indication of appropriate model fitting. It also throws light on the significance of the predictors.

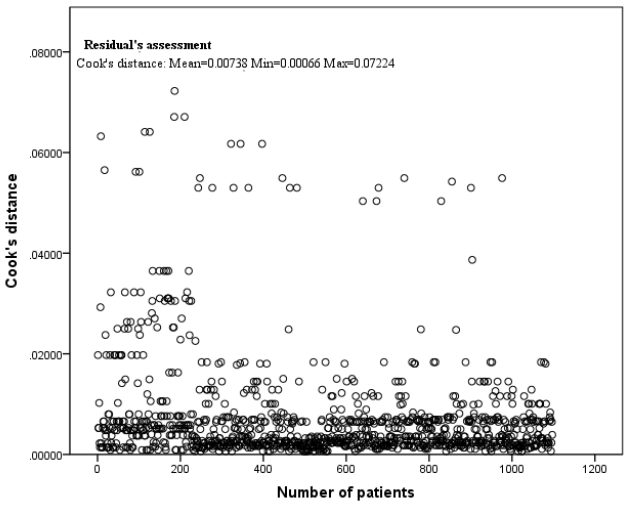

Fig 2: Scatter plot of Cook's distance.

Wald's statistics also showed significant results for all the predictors (*p value < 0.05) except irregular dental visits and irregular brushing habits (table 3). It implies that age, gender, education, regular brushing, and regular dental visits making significant contribution to the prediction of periodontitis. The odd's ratio (e^b), after adjusting for the levels of other predictors, reported the strength and direction of association between the predictors and the outcome. The strongest association was seen between periodontitis and brushing habits of the patients as the patients who brush their teeth once or twice daily (regular brushers) have 3.4 (OR > 1) times the odds of not getting periodontitis (absence) than those who don't brush their teeth. Similarly, the odds of absence of periodontitis for regular visitors are 3.21 times as great as for the reference group (never visited). However, odd's ratio < 1 was found for irregular dental visits, irregular brushing habits and gender indicating that these patients correspond with lower odds of not suffering from periodontitis as compared to their reference groups. For gender (OR=0.74), the odds of absence of periodontitis are 26% lesser for males as compared to the females (table 3).

TABLE 3: Forward stepwise binary logistics regression analysis using periodontitis as dependent variable

INDEPENDENT VARIABLES	Regression coefficient (b)	Wald's statistics	Significance (p-value)	Odd's Ratio (e^b)	95% C.I for Odd's ratio
Age (18-49)	1.064	26.812	0.000*	2.9	1.9-4.3
Gender (male)	-0.3	4.816	0.028*	0.74	0.56-0.96
Education status (≥ 12 years of education)	0.43	8.319	0.004*	1.54	1.15-2.06
Brushing habits (irregular)	-0.049	0.026	0.871	0.95	0.52-1.72
Brushing habits (regular)	1.216	30.977	0.000*	3.37	2.19-5.17
Past dental visits (irregular)	-0.229	2.66	0.103	0.8	0.60-1.04
Past dental visits (regular)	1.171	18.87	0.000*	3.21	1.9-5.4

**significant p-value i.e. < 0.05*

The plot of predicted probabilities for two most significant predictors, age and past dental visits is shown in fig 3. Predicted probabilities are calculated from the fitted regression model to quantify the chance of outcome (periodontitis) present or absent.

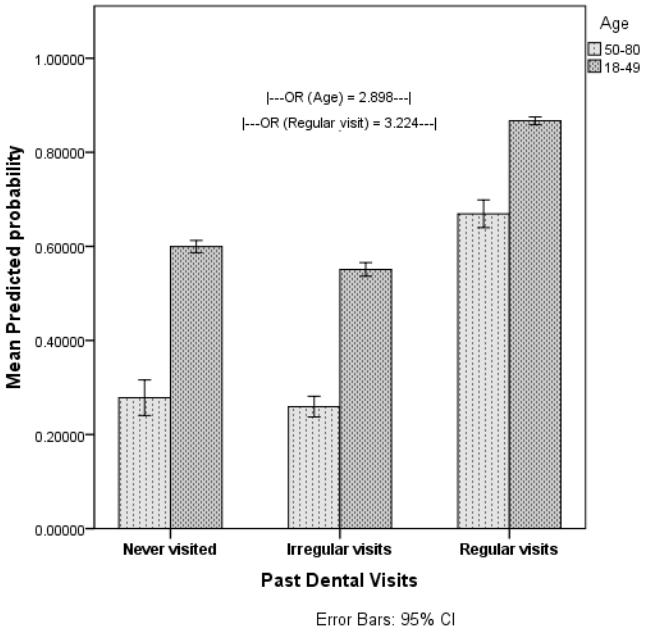

Fig 3: Plot of predicted probabilities for age and past dental visits.

4. DISCUSSION

This study reports the frequency and risk indicators of periodontitis among the patients reporting to Islamabad Medical and Dental College (dental section). Of all patients, 471 (42.9%) were diagnosed with periodontitis. As previously mentioned, the data in the present study included systemically healthy patients only, 42.9% of systemically healthy patients suffering from irreversible disease like periodontitis is a situation to be encountered and controlled before it gets worse. Similar prevalence was reported in dental institutes of Rawalpindi and Multan with 34.5% and 48.49% patients respectively.[5,16] On the contrary, prevalence of periodontitis reported by Haq

MW et al., in patients having systemic illness was higher (92%) as compared to the present results.[17] However, above mentioned researches included unhealthy individuals and smokers as well, which have masked the presence of periodontitis in systemically healthy patients, thus obscuring the importance of prevention of periodontitis in healthy individuals.

In regression analysis (table 3), the strongest predictor of periodontitis was found to be brushing habits with odd's ratio 3.37 (C.I.=2.19-5.17). This prediction indicates patient's brushing their teeth regularly (once daily) have 3.37 times greater odds of being safe from periodontitis than those who do not brush regularly. Although this is an established fact in general population, but since the population chosen in this research was systemically healthy, non-tobacco using individuals therefore, the importance of regular brushing habits should be reinforced in this population as well, as it has been in diabetics, obese and tobacco users.[17] Furthermore, patients brushing their teeth irregularly (occasionally) had similar odds of being safe from periodontitis than those who do not brush their teeth at all (OR = 0.95, C.I.=0.52-1.72). Therefore, counselling/oral hygiene education to brush teeth regularly should be delivered to every individual (whether systemically healthy or unhealthy) for the betterment of oral hygiene [18] so that overall incidence and prevalence of periodontitis can be controlled. This result is also consistent with another study from Rawalpindi reports a significant correlation of regular brushing habits with better periodontal health on applying chi-square but in their stepwise regression analysis only age, occupation and smoking are significantly related to periodontitis.[5] This indicates how the effect of brushing habits was masked in regression analysis due to the presence of other strong variables and odd's ratio could not be calculated. A meta-analysis reported 34% lower odds of periodontitis in patients brushing regularly supporting the aforementioned results.[19] Most of studies chosen in this meta-analysis were also on the general population therefore the exact odd's ratio for systemically healthy patients is difficult to analyze.

The second strongest association was of patients who visit dentists regularly which showed 3.21 times greater odds (C.I.=1.9-5.4) of being safe from periodontitis than those who never visited before (table 3). International researchers from Sweden in a 30-year outcome of preventive dental care highlighted the importance of regularity of dental visits in association with periodontal disease and caries.[20] A meta-analysis reported that subjects who regularly visited dentists at least once a year had 44% lower risk of periodontitis than those who did not.[19] Also researches from New York and North Jordan have reported similar results.[9,10] All the references given in this context are on general population and none of them is done exclusively on systemically healthy individuals. Furthermore, insignificant difference was seen in patients visiting irregularly and those who never visited before having (OR=0.79, C.I=0.60-1.04). The main reason behind this result was the irregular visitor are the patients who usually report to a dentist only when they have some severe dental issues like carious teeth, bleeding gums, pain, etc. As reported by Aliudddin AM et al. Pakistani population is reluctant to visit dentists due to multiple reasons and it is a common thought in the patients to report to the dentist only if they have severe dental problem (falling into the category of irregular visitors) [21], therefore their odds of being safe from periodontitis is similar to those who never visited thus highlighting the importance of regularity of dental visits. In Pakistan, it has been noticed that minimal amount of patients shows up for regular dental visits [21], most of which have underlying systemic disease due to which they are more concern about dental hygiene.[22] Referring to results of current research this routine should be changed by educating the healthy and non-smoking individuals about the importance of regular dental checkups as well as educating them about their predilection towards periodontitis on ignorance and also educating them about the consequences of periodontitis.

Age was also significantly associated with periodontitis (table 3) indicating that individuals < 50 years old have 2.9 times greater odds of being safe from periodontitis than ≥ 50 years of age (C.I.= 1.9-4.3). Although the association between periodontitis and age is also well-established fact [3-5] but in most of the researches it has been studied without excluding the other systemic conditions. Elderly population is more prone to infections and diseases due to the adverse effects of aging on adaptive as well as innate immune response [23], thus leading to chronic diseases. Direct relation of aging on periodontal loss as well as indirect effect through chronic systemic conditions indicates equal importance of education and awareness of systemically un healthy as well as systemically

healthy elderly population for the prevention of periodontitis. Since aging cannot be modified but educating individuals beforehand about their periodontal health regardless of systemic health is an essential requirement to control this irreversible disease in the upcoming era.

Regression analysis also showed 1.5 times greater odds of being safe from periodontitis (C.I.= 1.15-2.06) in patients with ≥ 12 years of education (table 3). This significant result is in contrast with the results reported from Multan, where an insignificant relation was reported between education status and dental disease.[16] This difference can be due to the inclusion of cofounders like smoking and systemic diseases which might have masked the significance of education in the results of the respective study. However, according to a study conducted in North Jordan, there is 5.5 times greater chance of periodontitis in patients with low education level [9], which supports the results of present study. Higher prevalence of periodontitis among subjects with low education has also been reported in several other international studies.[8,12,24] Although levels of education cannot be modified in majority, but the thoughts of uneducated patients can be modified by counselling them through educational and awareness programs which emphasize on oral hygiene care.[18]

Periodontitis predilection was seen in male in cross-tabulation as well as there are studies indicating that the incidence of periodontitis is greater in males [19], however gender association was not seen in regression analysis indicating equal chances of females and males to suffer from periodontitis (OR = 0.74, C.I.=0.56-0.96).

It should be noted that because this study was conducted on a group of patients referred to a periodontal department for treatment, the results are not likely to reflect the characteristics of whole population. Further large-scale, community-based studies on general population are required to determine the true prevalence of periodontitis in systemically healthy individuals in Pakistan.

5. CONCLUSION

Systemically healthy patients of age < 50 with regular brushing habits, having regular dental visits and well educated had more chance of being safe from periodontitis as compared to those systemically healthy patients who were ≥ 50 years of age with the irregular or no brushing, irregular dental visits and education ≤ 12 years.

These risk predictors can help in prediction of periodontitis in systemically healthy patients reporting to clinics with lower education status, irregular brushing habits, irregular dental visits.

RECOMMENDATIONS

Frequently, diabetics or smoker patients are more stressed upon for regular dental visits and a good oral hygiene as they are considered at high risk for periodontitis. This study shows periodontitis is also prevalent in healthy patients (42.9%) thus highlighting the importance of routine dental examination, education of patient and regular brushing habits.

On the basis of the risk indicators identified in the present study and high prevalence of Periodontitis, it is high time that community health programs in Pakistan should be modified and innovative techniques should be employed to maximize the dental awareness of general population and increase the frequency of timely dental visits.

INFORMED CONSENT

Informed consent was obtained from all the patients at the time of obtaining data (history, periodontal charting and radiographs etc.). Patients were informed that these data will be used in future researches however protection of privacy and human rights will be carried out at each and every stage.

ETHICAL APPROVAL

Permission from Institutional Review Board (IRB) was obtained before the start of the research (letter attached). All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

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