Original Article

Periodontal Disease as a Risk Factor for Coronary Artery Disease

Saeed Sadeghian, MD*, Feryal Taleghani, MD, Abdorreza Dorafshan, MD, Maria Raissi Dehkordi, MD

Tehran Heart Center, Tehran University of Medical Sciences, Tehran, Iran.

Received 26 May 2006; Accepted 4 Agust 2006

Abstract

Background: *Coronary artery disease is recognized as one of the three major causes of mortality around the world. The role of inflammation in producing coronary artery disease has been established in previous studies. Since periodontal disease, which is highly prevalent, is considered as a cause of inflammation, its influence on producing coronary artery disease was investigated in the present study considering its four main indices.*

Methods: *In this case-control study, 60 patients with angiographically proven coronary artery disease were selected as case group After matching for some baseline characteristics including educational level, age, sex, and some established risk factors for coronary artery disease, 60 healthy individuals were selected as control group from a population in whom coronary artery disease had been angiographically ruled out. Then, the existence of periodontal diseases was compared with statistical methods in these two groups, considering four different dental indices.*

Results: *The mean plaque index (PI) was 57.82±2.92% in cases vs. 35.73±2.53% in controls ($p<0.05$). Mean bleeding on probing (BOP) was 36.3±3.38% in cases versus 18.6±2.6% in controls, while mean Attachment Loss>4mm was 35.14±3.89% and 15.48±2.79% in cases and controls, respectively ($P<0.05$). The mean loss of teeth (LOT) was not significantly different in cases and controls (5.08±0.52 versus 5.38±0.53, $P>0.05$). Therefore, except for the number of lost teeth, there was a statistically significant difference between these two groups. For an evaluation of independent variables, multiple logistic regression analysis was used. Odds ratio was 1.02 for attachment loss and 2.2 for BOP.*

Conclusion: *Periodontal diseases may be counted as a risk factor for coronary artery disease and it is essential to study the effects of control and management of these diseases as primary and secondary prevention for coronary artery disease in future studies.*

The Journal of Tehran Heart Center, V 1, N 2 (2006) 105-108

Keywords: *Periodontal disease • Dental plaque index • Coronary artery disease*

Introduction

Periodontal diseases are one of the most common chronic diseases with an infectious origin, which cause inflammatory destruction of periodontal tissues. This condition is caused after contact of periodontium with dental plaques, which contain more than 400 bacterial species. Destruction of periodontium is caused by the release of toxic agents and enzymes from specific species of plaques and host response to bacteria and their products.[1] Because of the wide spectrum of microbial plaques associated with, and chronicity of periodontal diseases, presence of local and systemic immune responses, and the development of inflammation, this condition may also affect the course of some systemic

Corresponding Author:** ***Saeed Sadeghian, *Assistant professor of cardiology, Tehran University of Medical Sciences, Tehran heart Center, Tehran, Iran. 1411713138. Tel: +98-21-88029270. Fax: +98-21-88029731. Email: sadeghian15@yahoo.com.*

diseases.[2] For example, inflammation has an established role in the development and exacerbation of coronary artery disease, which is one of the most important causes of mortality in most communities. Interestingly, the classic risk factors such as hypertension and cigarette smoking count for only two-thirds of cardiovascular events. Therefore, other factors may also contribute to the pathogenesis of this disease. According to some studies, the prevalence of mortal cardiovascular events is 1.5 to 2 times greater in patients with periodontal diseases.[3,4] This issue has been discussed and reemphasized in newly-published studies, too. However, most of the data about this relationship has been regarded as inconclusive.[5] With regards to the lifestyle, oro-dental healthcare status and high prevalence of periodontal and cardiovascular diseases in Iran, we decided to evaluate the relationship between these two conditions in a case-control study.

Methods

Sampling

This analytical, case-control study was conducted on patients with angiographically-proven coronary artery disease. Toothless patients, patients suffering from immune diseases and diabetes mellitus, and patients receiving chemotherapy or hormones were excluded from the study. The characteristics of 60 patients were obtained through interviews, completion of fixed questionnaires (including age, sex, educational level, positive family history and other risk factors for coronary artery disease) and physical examination (measurement of body weight and height, blood pressure and blood sugar). Thereafter, 60 healthy individuals were selected as the control group from a population in whom coronary artery disease had been ruled out according to angiography. They were matched with the control group, according to some baseline characteristics, as much as possible. Finally, these two groups were similar in age, sex, educational level, serum levels of cholesterol and triglyceride, hypertension, hyperlipidemia, positive family history, smoking, and body mass index (BMI).

Oral Examination

A dentist examined teeth in both case and control groups on hospital beds with mirror, Williams probe and cotton role. Periodontal tissues in $\frac{61 \mid 145}{641 \mid 16}$ teeth were examined in patients. Teeth were selected according to Ramford and oral hygiene index (OHI). The degree of attachment, plaque index (O'leary), BOP (bleeding on probing) and the number of lost teeth (without considering the third molar) were measured. Measurement of AL was done with regard to cementoenamel junction (CEJ) of teeth. Measurement of AL>4mm was done in 6 areas of each tooth (mesiobuccal, midbuccal, distobuccal, mesiolingual, midlingual, distolingual). In order to measure BOP, the probes were slightly intruded into the sulcus of gums in each tooth. The occurrence of bleeding after 30 seconds in O'leary chart was registered and calculated according to this formula:

$$BOP = \frac{\text{Bleeding areas}}{\text{Total areas}} \times 100$$

In order to calculate plaque index, patients were given plaque-enhancing pills. The colored areas were calculated in 4 areas in O'leary chart according to this formula:

$$PI = \frac{\text{Colored areas}}{\text{Total tooth areas}} \times 100$$

T-test and chi-square and multiple logistic regression tests were used for data analysis. Data were analyzed with SPSS software.

Results

The characteristics of case and control groups are shown in tables (1 to 3).

Table 1. Distribution of relative frequency of age in case and control groups as divided by sex

	Cases *		Controls*	
Age group	**Male**	**Female**	**Male**	**Female**
30-50 Y	8 (13.3%)	8 (13.3%)	10 (16.7%)	7 (11.7%)
≥ 50 Y	32 (53.3%)	12 (20%)	30 (50%)	13 (21.7%)
Total	40 (66.7%)	20 (33.3%)	40 (66.7%)	20 (33.3%)

Data are presented as the number (%) of patients
*Non-significant P values

Table 2. Distribution of frequency of educational level in case and control groups

	Cases*	Controls*
No education	7 (11.7%)	5 (8.3%)
Under diploma	22 (36.7%)	20 (33.3%)
Diploma	17 (28.3%)	21 (35%)
Associate degree	8 (13.3%)	6 (10%)
Bachelor and over	6 (10%)	8 (13.3%)

Data are presented as the number (%) of patients
*Non-significant P values

Table 3. Frequency of family history of coronary artery disease, cigarette smoking, level of triglyceride, cholesterol and blood pressure in cases and controls

	Cases*	Controls*
Positive Family history	22 (36.7%)	17(28.3%)
Cigarette Smoking		
<10 pack / year	7 (11.7%)	5 (8.3%)
>10 pack / year	8 (13.3%)	8 (13.3%)
Level of Triglyceride		
TG<200	42 (70%)	48 (80%)
200<TG<400	15 (25%)	11 (18.3%)
TG>400	3 (5%)	1 (1.6%)
Level of Cholesterol		
chol <200	20 (33.3%)	27 (45%)
200<chol<240	23 (38.3%)	22 (36.7%)
chol ≥240	17 (28.3%)	11 (18.3%)
Blood pressure		
Normal	48 (80%)	45 (75%)
High	12 (20%)	15 (25%)

TG, triglyceride; chol, cholesterol
Data are presented as the number (%) of patients
*Non-significant p values

T-test showed no significant difference in age, gender, level of cholesterol and triglyceride and BMI between these 2 groups (P>0.05). U. Mann-Whitney and X^2 were used for comparison of educational level, hypertension and family history, which showed no significant difference between cases and controls (P>0.05).

The results of orodental examination in patients and controls according to 4 indices, including the number of lost teeth, BOP, PI and percentage of AL ≥ 4mm are as follows:

1. The mean number of lost teeth was 5.08±0.52 in cases and 5.38±0.53 in controls, which did not show a significant difference. (P>0.05)
2. There was a significant difference in BOP between cases (36.3±3.38%) and controls (18.6±2.63%). (P<0.05)
3. There was a significant difference in PI between cases and controls (57.82±2.92% vs. 35.73±2.53%). (P<0.05)
4. The mean attachment loss ≥ 4mm was 35.14±3.89% and 15.48±2.79% in cases and controls, respectively. (P<0.05)

For an evaluation of independent variables, multiple logistic regression analysis was used. Odds ratio was 1.02 for attachment loss and 2.2 for BOP (table 4).

Table 4. Indices of oro-dental health in cases and controls*

	Cases	Controls	P value	Odds Ratio
LOT (n)	5.08 ± 0.52	5.38 ± 0.53	> 0.05	
BOP (%)	36.03 ± 3.38	18.6 ± 2.63	< 0.05	2.2
PI (%)	57.82 ± 2.19	35.73 ± 0.53	< 0.05	
AL>4 (%)	35.14 ± 3.89	15.48 ± 2.79	< 0.05	1.02

LOT, Loss of Teeth; BOP, Bleeding On Probing; PI, Plaque Index; AL, Attachment Loss
* Results are expressed as mean ± standard deviation

Discussion

This study was aimed to evaluate the association between periodontal diseases and coronary artery disease. Our findings show that mean plaque index in the case group was twice as much as in the control group, which indicated bad health care in patients. The index of gum bleeding and records of the number of AL ≥ 4mm was used for the evaluation of periodontal status and gum inflammation. In some studies, this finding has been used as an index for increased chance of coronary artery disease. In 1999, Arbes divided the percentages of the areas with AL ≥ 3mm as to 0 to 33%, 33% to 67% and over 67%, with increased risk of coronary artery disease as 1.4, 2.3, and 3.8, respectively.[6] Elter et al showed that individuals with both high rates of attachment loss and tooth loss had elevated odds for prevalent coronary artery disease compared to individuals with low attachment loss and low tooth loss.[7] In a study that was done in 2000 in Shahid Beheshti University of Medical Sciences, dentistry school, the association between ischemia and gum inflammation was evaluated. The odds ratio for this disease was 11.7, which was much higher than similar studies done outside Iran. In our study, too, the mean percentage of AL ≥ 4mm in cases was 2.5 times as much greater as in controls.

The other index for gum inflammation was the mean amount of BOP which was twice as much in patients. This correlated with Gulnur's studies in 2000.[2] This was regarded as another reason for the prevalence of coronary artery disease in patients who do not have a good oro-dental health care. In a newly-published work, Briggs et al showed that higher proportion of sites examined in cases had plaque and bleeding on probing compared to controls.[8]

The mean number of lost teeth did not show a significant difference between cases and controls, which was consistent with Destefano's study in 1993.[9] Another research done by Karimi in Iran also showed the same results, which showed a significant difference with Moghaddasi's study. Similar to Moghaddasi et al, Briggs et al showed that cases with coronary artery disease had an average of three teeth less than the controls.[8]

Conclusions

Since 3 main indices out of 4 indices for periodontal diseases correlated with increased risk of ischemia in our research and most other studies, periodontal disease may be regarded as an independent risk factor for coronary artery disease. Hence, programs for public education and increase of health facilities must be considered for control of these diseases. The effect of this management on prevention of coronary artery diseases should be evaluated in future studies.

References

1. Scannapieco FA. The Research, science and therapy committee of the American Academy of Periodontology: periodontal disease as a potential risk factor for systemic disease. J periodontal 1998;69:841-850.
2. Genco R, Offenbacher S, Beck J, Rees T. Cardiovascular diseases and oral infections. In: Rose LF, Genco R, Cohen DW, Mealey BL, eds. Periodontal Medicine. Ontario: BC Decker Inc; 2000. p. 63-82.
3. Mattila KJ, Nieminen MS, Valtonen VV, Rasi VP, Kesaniemi YA, Syrjala SL, Jungell PS, Isoluoma M, Hietaniemi K, Jokinen MJ. Association between dental health and acute myocardial infarction. BMJ 1989;298:779-782.
4. Mattila KJ, Valle MS, Nieminen MS, Valtonen VV, Hietaniemi KL. Dental infections and coronary atherosclerosis. Atherosclerosis 1993;103:205-211.
5. Bokhari SA, Khan AA. The relationship of periodontal disease to cardiovascular diseases. J Pak Med Assoc 2006;56:177-181.
6. Arbes SJ, Slade GD, Beck JD. Association Between Extent of Periodontal Attachment Loss and Self Reported History of Heart Attack: an analysis of NHANES III Data. J Dent Res 1999;98:1777-1782.
7. Elter JR, Champagne CM, Offenbacher S, Beck JD. Relationship of periodontal disease and tooth loss to prevalence of coronary heart disease. J Periodontol 2004;75:782-790.
8. Briggs JE, McKeown PP, Crawford VL, Woodside JV, Stout RW, Evans A, Linden GJ. Angiographically confirmed coronary heart disease and periodontal disease in middle-aged males. J Periodontol 2006;77:95-102.
9. Destefano F, Anda RF, Kahn HS, Williamson DF, Russell CM. Dental disease and risk of coronary heart disease and mortality. BMJ 1993;306:688-691.