

A periodontal health assessment of hospitalized patients with myocardial infarction

Babak Amoian (DDS, MS)¹
Avideh Maboudi (DDS, MS)^{*2}
Vahid Abbasi (DDS)¹

1- Dental Materials Research Center, Babol University of Medical Sciences, Babol, Iran.
2- Department of Periodontics, Dental Faculty, Mazandaran University of Medical Sciences, Sari, Iran.

*** Correspondence:**
Avideh Maboudi, Department of Periodontics, Dental Faculty, Mazandaran University of Medical Sciences, Sari, Iran.
Postal Code: 48168-95475

E-mail: mavideh@yahoo.com
Tel: 0098 151 3244894
Fax: 0098 151 3244894

Received: 10 Feb 2011
Revised: 15 April 2011
Accepted: 25 May 2011

Abstract

Background: Recent researches have known long term infections such as periodontal disease to be related with the process of atherosclerosis. Periodontitis causes peripheral inflammation and immune cell stimulation which leads to an increase in C - reactive protein (CRP) and IgA Ab and there is a definite relation between cardiovascular disease, CRP increase and Periodontitis. The aim of this study was to evaluate the periodontal health status of patients with myocardial infarction who were hospitalized in Babol and Sari Hospitals.

Methods: This descriptive study was done on 95 men and women age ranging from 40 to 70 years old hospitalized due to myocardial infarction diagnosis in Babol and Sari Hospitals. Periodontal health, of patients evaluated via Cowell Bleeding Index, Green and vermilion Debr Index, Tooth Mobility, Clinical attachment Level on Ramfjord teeth. Data were analyzed with SPSS and Kruskal-Wallis test and Mann-whitney test.

Results: Considered indexes were evaluated in 81men and 14 women studied which showed no significant difference among them in the average BI ($p=0.52$), average tooth mobility ($p=0.117$) and average CAL index ($p=0.745$). The only significant difference between men and women was found in average DI index ($p=0.08$). There was a significant difference between average CAL in Ramfjord teeth of upper and lower jaw ($p=0.002$).

Conclusion: According to high prevalence of periodontitis in our study, periodontitis may be a risk factor of cardiovascular disease, it should be pointed out that here is the cardiologists' emphasis on their patients referring to the dentists.

Key words: Periodontitis, Myocardial Infarction, Clinical Attachment Level, Bleeding Index, Debr Index.

Caspian J Intern Med 2011; 2 (2):234-239.

The most common death cause in American adults aged over 65 years is cardiac diseases (1). In general, cardiovascular diseases have two main risk factor groups (acute and chronic). Atherosclerosis as a chronic risk factor with narrowing cardiac vessels and thrombosis as an acute one, with blocking cardiac vessels; that can cause cardiac ischemia and finally infarction (2). Recent researches have known long term infections such as periodontal disease related to the process of atherosclerosis (3). This disease is one of the initiators of cardiovascular complications (4).

It is observed that periodontal pathogens have caused atherosclerotic lesions. Periodontitis causes peripheral inflammation and immune cell stimulation which leads to an increase in C - reactive protein (CRP) and IgA Ab and there is a definite relation between cardiovascular disease, CRP increase and periodontitis (5). Periodontal bacteria can penetrate the circulation and then set off to the main organs and make new infections (6). Some of the bacteria responsible for periodontal disease such as *prophyromonas gingivalis* and *tanerella forsythus* and *campylobacter rectus* are among the atherosclerosis-causing bacteria (7) and recent studies have shown the ability of *prophyromonas gingivatis* in attacking endothelial cells.

This process can also define some of the relations between periodontal and cardiac disease (8). In Holmlund's study in 2009, it was observed that among the patients with periodontal disease; the IgG level against *prophyromonas gingivatis* was higher in those suffering from acute myocardial infarction (AMI). Moreover, it defined that people suffering from MI show more periodontal bone loss (PBL), deep periodontal plaques and more bleeding sites during probing when compared to the control group (9). It was shown in Pussinen's study that the increase in IgG for women and IgA for men could be an identical factor (10). Furthermore, patients suffering from MI had more frequency of PD ($PD \geq 4$ mm) when compared to controls (11).

Czerniuk et al, Cueto et al. and Pussinen et al. have indicated that periodontal disease is related to MI (10, 12, 13). Elter and Kaisare have stated that the number of lost teeth is associated with cardiac ischemia statistically (14, 15). Holmlund et al. explained that the number of teeth is associated with the incidence of age-related MI but has no relation to hypertension (16).

The aim of this study was to evaluate the periodontal health status of patients with Myocardial infarction who were hospitalized in Babol and Sari Hospitals.

Methods

This is a descriptive-analytical study and the study population included 95 men and women age ranging from 40 to 70 years old who were hospitalized due to myocardial infarction. The number of the studied population was determined based on prior studies (17, 18). Periodontal health, bleeding indicator (19), debris indicator (20), tooth mobility (19) and clinical level of attachments (19) were evaluated on Ramfjord teeth (including $\frac{6}{4} \frac{14}{6}$ teeth).

If these teeth were absent, the following teeth were examined and if those were absent too, the patients were excluded from the study. On the other hand, the data included gender, age, systemic disease, drug intakes, the number of infarction incidence, the time of the last infarction and duration of hospitalization were gathered from each patient's file and recorded in their forms. In order to perform this study, all patients (as they had complete bed rest) were examined while lying down in the same position in the hospital bed in an upright position. In the evaluation of bleeding index, based on periodontitis it was taken to

gingival sulcus of buccal and lingual sides of the Ramfjord tooth. After evaluating the bleeding index on buccal and lingual side of the tooth, its average was measured for each patient. In order to define debris index, dental probe was used in Green and vermilion Debris Index method. After grading of the lingual and buccal surfaces for each tooth, the average index was determined for each patient.

Headed for measuring clinical attachment level, from CEJ of each tooth to the sulcus depth in both buccal and lingual sides were measured using periodontal probe and the average was determined for each patient.

For measuring tooth mobility, one side of the tooth, it was held with metal instrument and the other side with the index finger and moved in bucco-lingual and vertical directions and the tooth mobility was graded based on tooth movement. The data was entered to SPSS statistical software and was analyzed using Kruskal-Wallis and Mann-Whitney tests when appropriate.

Results

Among the patients suffering from acute myocardial infarction who were hospitalized in Sari and Babol hospitals, 164 patients were excluded from the study due to the absolute absence of teeth, 4 due to being uncooperative and 3 of them was because of their young age. From the study on 95 patients, these results were obtained. The systemic disease condition of the cases was as follows: high blood lipid profile (24 cases), diabetes (22), hypertension (8), kidney transplant (1) and the duration of hospitalization were 1-10 days. Eighty one patients were males and 14 females. The patients' age range was between 40-70 years old mean 52.9 ± 9.9 and their distribution in different age groups was as follows. Forty one patients were in 40-51 years old group, 28 in 51-60 and 26 in 61-70 years old group. The range of tooth mobility, average BI, average DI, average CAL index were (0-2), (0-1.67), (0-3), (0-11) respectively (Table 1,2). We found these results while evaluating the average studied indexes (Table 3). The considered indexes were evaluated in studied men and women which showed no significant difference among them in the average BI ($p=0.52$), average tooth mobility ($p=0.117$) and average CAL index ($p=0.745$). the average DI index was only significant difference between men and women found ($p=0.08$), in men is larger.

Table1: frequency and percentage of average TOOTH MOBILITY, BI and DI in patients suffering from MI.

Average tooth mobility	Frequency	Percentage	Average BI	Frequency	Percentage	Average DI	Frequency	Percentage
0	62	65.3	0	57	60	0	3	3.2
0.17	7	7.4	0.17	3	3.2	0.17	3	3.2
0.33	4	4.2	0.33	11	11.6	1	12	12.6
0.5	8	8.4	0.5	8	8.4	1.17	8	8.4
0.83	3	3.2	0.67	3	3.2	1.33	8	8.4
1.5	4	4.2	0.8	2	2.1	1.5	10	10.5
1.67	3	3.2	0.83	4	4.2	1.67	2	2.1
2	4	4.2	1	4	4.2	1.83	2	2.1
Total	95	100	1.67	3	3.2	2	12	12.6
			Total	95	100	2.17	5	5.3
						2.33	6	6.3
						2.5	5	5.3
						2.67	10	10.5
						3	9	9.5
						Total	95	100

Table 2: frequency and percentage of average CAL in patients suffering from MI.

Average CAL (mm)	Frequency	Percentage
0	33	5.8
1	63	11.1
2	221	38.8
3	79	13.9
4	92	16.1
5	35	6.1
6	23	4
7	12	2.1
8	8	1.4
11	4	7
Total	570	100

Moreover, the studied parameters in different age groups were evaluated which showed no significant difference between average tooth morbidity ($p=0.48$), BI ($p=0.69$) and DI ($p=0.19$). Simply CAL was significant when it was in different age groups ($p<0.001$) while evaluating the association between the average studied indexes with the frequency of infarction in the patients, there was no

significant difference between average mobility ($p=0.11$) and

DI ($p=0.40$) indexes in two groups of first infarction and more than one infarction groups; even though we found a significant difference between BI ($p=0.04$) and CAL index ($p<0.001$) and the frequency of infarction in patients. There was a significant difference between average CAL in Ramfjord teeth of upper and lower jaw ($p=0.002$). When CAL of each Ramfjord tooth of all patients was measured, the difference between the founded averages was statistically significant ($p<0.001$) and the most CAL was observed in the 6 teeth of the patients.

Table 3: Average of BI, DI, CAL and Tooth mobility

Studied group	Patients suffering from MI
Average of parameters	
CAL	2.83±1.79
DI	1.78±0.77
BI	0.25±0.39
Tooth mobility	0.29±0.56

Discussion

Holmlund et al, stated that people with more crest bone loss have a higher relative risk for cardio-coronary diseases than those lower level of bone loss (9). When CAL quantity was measured in patients suffering from myocardial infarction, the average CAL of all patients was 2.83 ± 1.79 mm. based on Carezza, mild periodontitis is characterized by loss of attachments by 1-2 mm, moderate periodontitis by 3-4mm and severe periodontitis by 5mm (2); thus 94.2% of our cases had periodontitis; 49.9% of which were mild periodontitis, 30% moderate and 25.7% severe periodontitis. In Desvarieux et al. study in 2009, the quantity of CAL in patients suffered from AMI showed a significant difference when compared to healthy individuals ($p=0.001$, 4.5 mm versus 5.4 mm) (21) which is compatible to the present study. In this study BI=0 was observed in sixty percent of the patients. The average BI in all patients was 0.39 ± 2.5 and also 96.8% had a DI more than zero. Debris is equivalent with bacterial plaque in this study. Some plaque forming bacteria such as campylobacter rectus, tannerella forsythus and prophyromonas gingivatis are also among the known atherosclerosis-causing bacteria. This process can clarify some of the relations between periodontal diseases and cardiac diseases (7).

Czerniuk et al. reported the average percentage of plaque and bleeding indexes in patients was 46% (less than the present study) and 80% (more than the present study), respectively (12). In another research by Dorn et al, prophyromonas gingivatis was introduced as a prominent factor in the plaque of patients suffering from MI, and in addition to prophyromonas gingivalis, other bacteria such as tannerella forsythus and aggregation bacteria were observed in a greater number in MI group when compared to the control group (22). Frank et al reported that poor mouth hygiene is associated to many systemic diseases, one of which is myocardial infarction (23). Karhunen stated that the low mouth hygiene was related in an increased risk of sudden cardiac death (24).

The teeth mobility rate which is one of the other factors for periodontal health was also considered in the present study and an average of 0.56 ± 0.29 was found an acceptable amount. Geerts revealed that the difference in periodontitis and its intensity, depth of probing, bleeding index, plaque index, furcation involvement and the amount of tooth mobility was significantly higher in patients suffered from cardiovascular diseases when compared to healthy individuals (25).

Desvarieux stated that men put up with periodontitis more than women (21). All the same in gender evaluation in our study, the debris index was significantly higher in men when compared to women, which shows inferior mouth hygiene in men. On the other hand, CAL in men was measured to be more than women which was not statistically significant. In our study, the inferior jaw CAL was more than the superior jaw and the most CAL was related to the first molar on the left lower side which we found no research on the subject among the studies related to periodontium. Furthermore, patients who were hospitalized due to their first infarction had a lower CAL and BI when compared to those hospitalized because of their several infarctions. This difference was significant and we found no similar study among other researches related to MI and periodontium, thus more studies are required on this matter.

Altogether, several cross sectional-longitudinal and case control studies have been conducted based on association between poor periodontal hygiene and cardiac diseases. Willershausen introduced periodontitis as a prohibiting factor for cardiovascular disease (26) or a study by Dorn in New York, USA showed periodontal disease to be a very important factor in causing cardiovascular incidents in patients with myocardial infarction (22).

Also, two other meta-analysis studies revealed a statistically significant difference between periodontal disease and acute myocardial infarction and recommended further studies in the different dimensions of this matter (13). The only study which denied the association between MI and periodontal disease was that of Hujuel et al which was a follow up study of 21 years (27). This finding maybe due to excessive deletion of the factors which are strongly associated with infections such as periodontal disease or there might be an incorrect categorization of periodontal disease from the beginning; meaning the individuals known to be healthy at the start of the study could get the disease within 21 years or patients known as periodontal patients could be treated in the meantime. Since there was high prevalence of periodontitis in our study, most similar studies introduce periodontitis to be an independent risk factor of cardiovascular disease, regardless of other classic risk factors, it should be pointed out here is the cardiovascular specialists emphasis on their patients referring to the dentists.

Acknowledgments

The authors gratefully acknowledge Dr. Payam Kabiri for his comments during the preparation of the manuscript and Dr.Reza Alizadeh for the statistical analysis of the data.

References

- Lynch MA, Brightman VJ, Greenberg MS. *Burket's oral Medicin Diagnosis and Treatment*. 10th ed, Hamilton, Bc: Deckent Inc 2003; pp: 605.
- Newman MG, Takei HH, Carranza F.A *clinical periodontology*. 10th ed. Philadelphia: W.B. Sauders co 2006; pp: 46- 7, 105-6,137, 155,315,320,550,584.
- Pucar A, Milasin J, Lekovic V, et al. Correlation between atherosclerosis and periodontal putative pathogenic bacterial infections in coronary and internal mammary arteries. *J Periodontol* 2007; 78: 677-82.
- Offenbacher S, Elter JR, Lin D, Beck JD. Evidence for periodontitis as a tertiary vascular infection. *J Int Acad Periodontol* 2005; 7: 39-48.
- Mattila KJ, Pussinen PJ, Paju S. Dental infections and cardiovascular diseases: a review. *J Periodontol* 2005 Nov;76(11 Suppl):2085-8.
- Newman MG, Takei HH, Caranza FA. *Clinical peridotology*. 9th ed. Philadelphia: WB. Saunders Co 2002; pp: 986-991.
- Roselous F, Genco R, Dwaiter C, Meale JB. *Priodontal Medicine - 18th ed*, Lewiston, BC. Decker 2000; pp: 11,73.
- Stein JM, Kuch B, Conrads G, et al. Clinical periodontal and microbiologic parameters in patients with acute myocardial infarction. *J Periodontol* 2009; 80: 1581-9.
- Holmlund A, Hedin M, Pussinen PJ, Lerner UH, Lind L. *Porphyromonas gingivalis* (Pg) a possible link between impaired oral health and acute myocardial infarction. *Int J Cardiol* 2009; 148: 148-53.
- Pussinen PJ, Alfthan G, Jousilahti P, Paju S, Tuomilehto J. Systemic exposure to *Porphyromonas gingivalis* predicts incident stroke. *Atherosclerosis* 2007; 193: 222-8.
- Stein JM, Kuch B, Conrads G, et al. Clinical periodontal and microbiologic parameters in patients with acute myocardial infarction. *J Periodontol* 2009; 80: 1581-9.
- Czerniuk MR, Gorska R, Fillipiak KJ, Opolski G. Inflammatory response to acute Coronary syndrome in patients with coexistent periodontal disease. 2004; 75: 1020-6.
- Cueto A, Mesa F, Bravo M, Ocana-Riola R. Periodontitis as risk factor for acute myocardial infarction. A case control study of Spanish adults. *J Periodontal Res* 2005; 40: 36-42.
- 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: 782-90.
- Kaisare S, Rao J, Dubashi N. Periodontal disease as a risk factor for acute myocardial infarction. A case-control study in Goans highlighting a review of the literature. *Br Dent J* 2007; 203: E5; discussion 144-5.
- Holmlund A, Holm G, Lind L. Severity of periodontal disease and number of remaining teeth are related to the prevalence of myocardial infarction and hypertension in a study based on 4,254 subjects. *J Periodontol* 2006; 77: 1173-8.
- Bochniak M, Sadlak-Nowicka J, Tyrzyk S, Sobiczewski W, Rynkiewicz A. [Periodontal and dental state of patients with coronary heart disease]. *Przegl Lek* 2004;61: 910-3. {In polish}
- Bochniak M, Sadlak-Nowicka J, Kedzia A, Sobiczewski W. [Bacteriological spectrum of periodontal pocket in patients with coronary heart disease and myocardial infarction]. *Przegl Lek* 2009; 66: 373-9. {In polish}
- Geisma K, Stoltze K, Sigurd B, Gyntelberg F, Holmstrup P. Periodontal disease and coronary heart disease. *J Periodontol* 2006; 77: 1547-54.
- Lopez R, Oyarzun M, Naranjo C, et al. Coronary heart disease and periodontitis -- a case control study in Chilean adults. *J Clin Periodontol* 2002; 29: 468-73.
- Desvarieux M, Demmer T, Rundek T, et al. Relationship between periodontal disease tooth loss and Carotid artery plaque: the oral Infections and vascular Disease Epidemiology study (INEST). *Stroke* 2003; 34: 2120-25.
- Dorn JM, Genco RJ, Grossi SG, et al. Periodontal disease and recurrent cardiovascular events in survivors of myocardial infarction (MI): the Western New York Acute MI Study. *J Periodontol* 2010; 81: 502-11.
- Scannapieco FA, Dasanayake AP, Chlaun N. "Does periodontal therapy reduce the risk for systemic diseases?". *Dent clin North Am* 2010; 54: 163-81.
- Karhunen V, Forss H, Goebeler S, et al. Radiographic assessment of dental health in middle-aged men following sudden cardiac death. *J Dent Res* 2006; 85: 89-93.
- Geerts SO, Legrand V, Charpentier J, Albert A, Rompen EH. Further evidence of the association between periodontal conditions and coronary artery disease. *J Periodontol* 2004; 75: 1274-80.

26. Willershausen B, Kasaj A, Willershausen I, et al. Association between Chronic Dental Infection and Acute Myocardial Infarction. *Endod* 2009; 35: 626-30.

27. Hujoel PP, Drangsholt M, Spiekerman C, DeRouen TA. Periodontal disease and coronary heart disease risk. *JAMA* 2000; 284: 1406-10.