

# THE CONDITION OF ORAL CAVITY HYGIENE AND PERIODONTIUM IN POST-MYOCARDIAL INFARCTION PATIENTS

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## ABSTRACT

**INTRODUCTION:** Poor oral hygiene is one of the main factors in the higher risk of dental caries and periodontal diseases and it may also affect the general health of the patient.

**OBJECTIVES:** The aim of the study was to assess the oral cavity condition, specifically the oral hygiene and periodontium status, in post-myocardial infarction patients.

**MATERIAL AND METHODS:** The research was based on 80 people, 32 women and 48 men aged 34-82. Within this sample of 80 people, 50 post-MI patients, 30 subjects with no cardiovascular diseases. To assess the hygiene and periodontal treatment needs the Oral Hygiene Index (OHI) and Community Periodontal Index of Treatment Needs (CPITN) were used.

**RESULTS:** 51.3% of post-MI patients had dental plaque (OHI = 1), 46.2% supra- as well as subgingival deposits (OHI = 2), 2.6% subgingival deposits (OHI = 3). In the control group 70% of the patients had good oral hygiene, but dental plaque (OHI = 2) was observed in 13.3%, and calculus (OHI = 2) in 16.7% of this group. In 79.5% of post-MI patients and only in 16.7% of the control group dental pocket depth < 3 mm (CPI = 2) was measured. These differences were statistically significant. The periodontium condition in female post-MI patients was worse; CPI = 2 was measured in 90% vs. 75.9% in male patients. None of the post-MI patients had a satisfactory periodontal tissues condition. Periodontal treatment needs were higher in the research group.

**CONCLUSION:** Within this sample of patients, it was found that the group of post-MI patients had poorer oral hygiene, worse periodontium condition and a higher need for periodontal treatments.

**KEY WORDS:** oral cavity hygiene, OHI, CPITN, myocardial infarction.

J Stoma 2018; 71, 5: 400-405

DOI: <https://doi.org/10.5114/jos.2018.84647>

## INTRODUCTION

Although medical knowledge of cardiovascular diseases (CVD) has grown, they are still the leading causes of human death in Europe and in the entire world [1]. Currently in Poland 87% of women and 69% of men

reach the age of 65 and respectively 54% and 29% the age of 80. Many studies show the connection between cardiovascular diseases and poor oral hygiene. There are connections between oral diseases and higher risk of infective endocarditis (IE) but also the development of atherosclerosis [2-4].

**JOURNAL OF  
STOMATOLOGY**  
CZASOPISMO STOMATOLOGICZNE

OFFICIAL JOURNAL OF THE POLISH DENTAL ASSOCIATION | ORGAN POLSKIEGO TOWARZYSTWA STOMATOLOGICZNEGO



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Maintenance of the appropriate oral hygiene prevents dental caries and periodontitis. Dental plaque and bacteria's metabolic products are considered to be direct factors of the inflammatory process. They may initiate bone resorption or stimulate inflammatory and immune reactions, which lead to advanced bone tissue atrophy. Appropriate hygiene reduces dental plaque associated with teeth surfaces and prosthodontic appliances. Saliva circulation disorders, resulting in increased retention of food debris, plus commutation of dental plaque on prosthodontic appliances, are the main problems of prosthetic patients. Periodontitis is more frequent in patients with inadequate oral hygiene habits [5-7].

## OBJECTIVES

This study aims to assess the oral condition, specifically the oral hygiene and periodontium status, in patients hospitalized for myocardial infarction.

## MATERIAL AND METHODS

The study was based on 80 people, 32 women and 48 men aged 34-82; the average age was 58 years old. The research group included 50 people, hospitalized in the Department of Cardiology of Medical University of Białystok (Poland) for recent uncomplicated myocardial infarction, treated with primary angioplasty (group I). Patients were examined on day 2 after incident cardiovascular events (CVEs). The group contained 16 women and 34 men, aged 50-82, and the average age was 64.4 years old. The control group included 30 people, generally healthy, who did not report any cardiovascular problems, and presented themselves in the dental office for check-ups (group II). The group included 16 women and 14 men, aged 43-75; the average age was 47.3 years old. The oral cavity condition was examined in artificial light using a dental mirror, dental probe and periodontal controlled-force probe (Paro Audio- Probe 9Esro AG, Switzerland). To assess the periodontium condition and treatment needs, the CPITN index was used (Communi-

nity Periodontal Index of Treatment Needs) [8]. Clinical periodontium condition was assessed with the CPI in equal parts of dental arches including 6 adjacent teeth (so-called sextant) according to a definite scheme. Periodontal pocket depth was measured around each tooth on 4 sides: vestibular, lingual, mesial and distal. The highest score for each tooth was obtained, and the mean number for all teeth was counted. Treatment needs (TN) were evaluated according to certain criteria.

To assess the oral hygiene the OHI was used (Oral Hygiene Index – Green and Vermilion) [8].

## STATISTICAL ANALYSIS

For the sake of statistical analysis, Statistica 10.0 (StatSoft Inc., USA) software was used. The results were represented with the help of numerical arrays along with percentages. Where variables were involved, we provided means and standard deviations. Relation analysis between the variables was conducted with the help of  $\chi^2$  dependency test and Spearman's rank correlation coefficient. Comparisons between groups were conducted with the Mann-Whitney *U* test (for both groups), ANOVA Kruskal-Wallis ranks test (in case of the three control groups) and the  $\chi^2$  test. The assumed significance level was  $\alpha = 0.05$ .

## RESULTS

The oral hygiene status, assessed with the help of the OHI index, was compared between groups with the  $\chi^2$  test, which showed no correlation ( $\chi^2 = 0.39$ ;  $df = 2$ ;  $p = 0.8219$ ;  $C = 0.09$ ). In the research group women's and men's oral hygiene status was similar and no significant difference was noted. Also no correlation in the control group was observed ( $\chi^2 = 4.48$ ;  $df = 2$ ;  $p = 0.1065$ ;  $C = 0.36$ ). In this group of women and men no significant differences of oral hygiene were noted, although good oral hygiene (OHI = 0) was observed more often in the female (76.2%) than the male (55.6%) population (Table 1).

**TABLE 1.** Oral Hygiene Index (OHI) comparison according to sex in groups

OHI	Group I				Group II			
	Women		Men		Women		Men	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
0	0	0.0	0	0.0	16	76.2	5	55.6
1	5	50.0	15	51.7	1	4.8	3	33.3
2	5	50.0	13	44.8	4	19.0	1	11.1
3	0	0.0	1	3.4	0	0.0	0	0.0
In total	10	100.0	29	100.0	21	100	9	100

Group I ( $\chi^2 = 0.39$ ;  $df = 2$ ;  $p = 0.8219$ ;  $C = 0.09$ )

Group II ( $\chi^2 = 4.48$ ;  $df = 2$ ;  $p = 0.1065$ ;  $C = 0.36$ )

**TABLE 2.** Oral Hygiene Index (OHI) comparison according to place of residence in research group

OHI	Group I			
	Small town		Big city	
	n	%	n	%
0	0	0.0	0	0.0
1	11	55.0	9	47.4
2	9	45.0	9	47.4
3	0	0.0	1	5.3
In total	20	100.0	19	100.0

( $\chi^2 = 1.17$ ;  $df = 2$ ;  $p = 0.5558$ ;  $C = 0.17$ )

The oral hygiene status in the research group was approximate in people from other places of residence; no significant difference was noted ( $\chi^2 = 1.17$ ;  $df = 2$ ;  $p = 0.5558$ ;  $C = 0.17$ ) (Table 2). The comparison was not made in the control group because the patients only came from a small town.

No significant differences of oral hygiene status depending on education in the research group were observed. In post-myocardial patients with elementary education or vocational education, oral hygiene status (OHI assessment) was slightly lower than in patients with secondary or higher education. Because

of the small number of people with basic education in the control group the interpretation of the results is difficult. Group I:  $\chi^2 = 1.48$ ;  $df = 2$ ;  $p = 0.4771$ ;  $C = 0.19$ ; group II:  $\chi^2 = 10.3$ ;  $df = 2$ ;  $p = 0.0058$ ;  $C = 0.51$  (Table 3).

In the control group of people with lower education the oral hygiene is definitely worse and the difference is statistically significant ( $\chi^2 = 10.3$ ;  $df = 2$ ;  $p = 0.0058$ ;  $C = 0.51$ ).

Table 4 presents the difference of oral hygiene status between research and control groups depending on smoking. However, no correlation in post-myocardial infarction group was noted ( $\chi^2 = 5.78$ ;  $df = 4$ ;  $p = 0.2158$ ;  $C = 0.36$ ) and no statistically significant dependence between oral hygiene and smoking in the research group was observed. Although in 64.7% of smokers the OHI was 2, in the non-smoker group that index was twice as low. In the control group no correlation was observed ( $\chi^2 = 3.23$ ;  $df = 4$ ;  $p = 0.5206$ ;  $C = 0.31$ ). No statistically significant differences were noticed, although OHI = 2 in 28.6% of smokers vs. 11.1% non-smokers was assessed.

Table 5 presents the periodontium condition assessed with the CPI in both groups depending on sex. No correlation in the research group ( $\chi^2 = 0.91$ ;  $df = 1$ ;  $p = 0.3397$ ;  $C = 0.15$ ) or the control group ( $\chi^2 = 4.47$ ;  $df = 2$ ;  $p = 0.1065$ ;  $C = 0.36$ ) was found. The assessed periodontium condition was similar in both women and men in the post-MI group. However, CPI was worse in

**TABLE 3.** Oral Hygiene Index (OHI) comparison according to education in both groups

OHI	Group I				Group II			
	Essential and vocational		Secondary and higher		Essential and vocational		Secondary and higher	
	n	%	n	%	n	%	n	%
0	0	0.0	0	0.0	1	16.7	20	83.3
1	12	52.2	8	50.0	2	33.3	2	8.3
2	11	47.8	7	43.8	3	50.0	2	8.3
3	0	0.0	1	6.3	0	0.0	0	0.0
In total	23	100.0	16	100.0	6	100	24	100

Group I ( $\chi^2 = 1.48$ ;  $df = 2$ ;  $p = 0.4771$ ;  $C = 0.19$ )

Group II ( $\chi^2 = 10.3$ ;  $df = 2$ ;  $p = 0.0058$ ;  $C = 0.51$ )

**TABLE 4.** Oral Hygiene Index (OHI) comparison according to smoking in both groups

OHI	Group I						Group II					
	Never smoked		Smokes		Ex-smoker		Never smoked		Smokes		Ex-smoker	
	n	%	n	%	n	%	n	%	n	%	n	%
0	0	0.0	0	0.0	0	0.0	7	77.8	8	57.1	6	85.7
1	6	66.7	6	35.3	8	61.5	1	11.1	2	14.3	1	14.3
2	3	33.3	11	64.7	4	30.8	1	11.1	4	28.6	0	0.0
3	0	0.0	0	0.0	1	7.7	0	0.0	0	0.0	0	0.0
In total	9	100.0	17	100.0	13	100	9	100.0	14	100.0	7	100.0

Group I ( $\chi^2 = 5.78$ ;  $df = 4$ ;  $p = 0.2158$ ;  $C = 0.36$ )

Group II ( $\chi^2 = 3.23$ ;  $df = 4$ ;  $p = 0.5206$ ;  $C = 0.31$ )

**TABLE 5.** Community Periodontal Index (CPI) comparison according to sex in both groups

CPI	Group I				Group II			
	Women		Men		Women		Men	
	n	%	n	%	n	%	n	%
0	0	0.0	0	0.0	16	76.2	5	55.6
1	1	10.0	7	24.1	1	4.8	3	33.3
2	9	90.0	22	75.9	4	19.0	1	11.1
3	0	0.0	0	0.0	0	0.0	0	0
4	0	0.0	0	0.0	0	0.0	0	0
In total	10	100	29	100	21	100	9	100

Group I ( $\chi^2 = 0.91$ ;  $df = 1$ ;  $p = 0.3397$ ;  $C = 0.15$ )

Group II ( $\chi^2 = 4.47$ ;  $df = 2$ ;  $p = 0.1065$ ;  $C = 0.36$ )

the female group; CPI = 2 was in 90% of women and in 75.9% of men. There were no 0, 3 or 4 CPI values in this group. The periodontium condition in the control group was satisfactory, in 76.2% of women and 55.6% of men the CPI was 0. CPI = 1 was found in 4.8% of women and 33.3% of the men. CPI = 2 was found in 19% of women and 11.1% of men. The differences were not statistically significant. In the research group the periodontium condition assessed with CPI was very similar with no relation to the place of residence, and no correlation of periodontium status was noted ( $\chi^2 = 0.01$ ;  $df = 1$ ;  $p = 0.9351$ ;  $C = 0.01$ ) (Table 6).

Treatment needs (TN) are presented in Table 7. 90% of women and 75.9% of men (research group) were characterized as TN = II category of treatment needs, which are: oral hygiene instructions and professional hygiene procedures. In the control group 19% of women and 11.1% of men had that kind of treatment needs. In both groups treatment needs of periodontium and hygiene were higher in women, and slightly lower in men. In the research group no differences of oral hygiene were noted according to sex. No correlation between maintaining good oral hygiene and the place of residence or education was observed. However, people with lower education were found to have poorer oral hygiene. The situation was similar with smokers.

**TABLE 6.** Community Periodontal Index (CPI) index comparison according to place of residence in research group

CPI	Group I			
	Small town		Big city	
	n	%	n	%
0	0	0.0	0	0.0
1	4	20.0	4	21.1
2	16	80.0	15	78.9
3	0	0.0	0	0.0
4	0	0.0	0	0.0
In total	20	100.0	19	100.0

Group I ( $\chi^2 = 0.01$ ;  $df = 1$ ;  $p = 0.9351$ ;  $C = 0.01$ )

Group II ( $\chi^2 = 4.47$ ;  $df = 1$ ;  $p = 0.1065$ ;  $C = 0.36$ )

In the research group the periodontium condition, assessed with the CPI, was worse than in the control group. No correlation between sex, place of residence or education and periodontal problems was observed. In the control group the periodontium condition was much better in people with higher education.

Dental pocket depth < 3 mm and dental calculus (CPI = 2) were observed in 79.5% of the research group and only in 16.7% of the control group; these differences

**TABLE 7.** Categories of treatment needs (TN) for both groups

TN	Treatment needs	Group I				Group II			
		Women		Men		Women		Men	
		n	%	n	%	n	%	n	%
I	Oral hygiene instruction	1	10	7	24.1	17	81.0	8	88.9
II	Oral hygiene instruction + professional hygiene procedures	9	90	22	75.9	4	19.0	1	11.1
III	Complex treatment	0	0	0	0	0	0	0	0

were statistically significant. The periodontium condition in women was slightly worse; CPI = 2 was assessed in 90% of them vs. 75.9% of men.

The TN were higher in the research group, but that did not correlate with either place of residence or the education. In 90% of women and 75.9% of men the category of TN was assessed as 2 (TN = 2), which means the need for oral hygiene instruction and professional hygiene procedures to be performed. This treatment plan needs to be carried out in 19% of women and 11.1% of men from the control group. In both groups the treatment needs were higher in females and slightly lower in the male population.

## DISCUSSION

The results of our research show that the oral hygiene of the research group was worse than in the control group. Dental plaque was present (OHI = 1) in 51.3% of post-MI patients, subgingival deposits (OHI = 2) in 46.2%, and OHI = 3 in 2.6% of patients. In the control group 70% of the patients had good hygiene, dental plaque was observed in 13.3% and dental deposits in 16.7% of patients.

Unsatisfactory oral hygiene, characterized as presence of fresh dental plaque, might be explained with hospitalization, having undergone surgery and problems with removing plaque effectively. However, presence of subgingival deposits in nearly half (46.2%) of the patients is evidence of permanent poor oral hygiene habits.

Similar observations were made by Parkar [3]; he noted statistically significant unsatisfactory oral hygiene in half of the post-MI patients.

Loeshe [4], in his study of 320 people over 60 years old, observed that people suffering from coronary artery disease had fewer teeth, wore prosthodontic appliances more frequently and had extreme calculus formation.

Herzberd and Meyer [5] paid close attention to fact that bad oral hygiene may increase the risk of bacteremia. He suggested that constant exposure to dental plaque bacteria may be the reason for the atherosclerosis plaque activation more often than other bacteria. Also Minassian *et al.* [6] stated that bacteremia during invasive dental procedures is usually directly connected with periodontal diseases. He considered that people with poor oral hygiene and periodontitis are in a high risk group of idiopathic bacteremia.

In the research group no differences of oral hygiene were found according to sex. No correlation between maintenance of good oral hygiene and the place of residence or education was observed. But in people with lower education worse oral hygiene was noted. The situation was similar with smokers.

In Berent *et al.*'s research [9] periodontium condition, assessed with the CPITN, was significantly worse

in patients with coronary artery disease compared to healthy people. The periodontium condition assessed with CPI = 3 was noted in 55.6% of patients suffering from heart diseases and 41.9% of the control group. The risk factors in the research group were male sex, age, high HDL-C level and diabetes mellitus.

Many authors have suggested that periodontal diseases may be risk factors of heart diseases. De Stefano *et al.* [10] in 1993 published the results of a prospective study based on 10 000 people in the USA suffering from heart diseases. That study showed increased, 50% higher, mortality rate in people suffering from coronary artery disease comorbid with periodontopathy. The research showed that relative risk (RR) of cardiovascular disease in patients with periodontitis is 1.25 times higher than in the population with healthy periodontium. However, Joshipura [11] in his study from 1996 did not find any relation between bad oral cavity condition and increased risk of heart diseases, although he found a positive relation with cerebral stroke.

Katz *et al.* [12] examined a population of 80 people with coronary artery disease; in 22.5% of his patients the periodontal pockets were deeper than 5.5 mm. However, the small percentage of people with healthy periodontium assessed by the authors – only 5% – was very similar to our own research.

Barilli *et al.* [13] observed similar differences in frequency of periodontal diseases' presence and periodontal treatment needs between people with coronary artery diseases and a control group. The highest treatment needs were about 8 times bigger in the research group than the control group. Engebretson *et al.*'s study [14] showed that the atherosclerosis plaque thickness depends on the periodontal disease status, smoking and HDL-C level.

## CONCLUSIONS

The oral cavity condition in patients hospitalized for myocardial infarction was unsatisfactory and worse than in the generally healthy population. Higher periodontitis level and periodontal treatment needs were found in the group of post-myocardial infarction patients compared to the control group. Unsatisfactory oral hygiene and related periodontal diseases are risk factors of cardiovascular diseases. The presented results show the necessity of creation and implementation of a professional preventive-therapeutic-educational program.

## CONFLICT OF INTEREST

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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