

Periodontal Status in Patients Suffering from Diabetes Mellitus in Relations to Glycosylated Hemoglobin Level and the Level of Oral Hygiene

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SUMMARY

Introduction It has been known that periodontitis is one of the most common oral diseases in patients having diabetes mellitus (DM). The aim of this study was to examine the influence of glycosylated hemoglobin (HbA1c) level and the level of oral hygiene on periodontal status of patients suffering from DM.

Material and Methods The research included 50 people with type 2 DM randomly selected. Based on values of HbA1c, patients were divided into two groups: well controlled DM (HbA1c \leq 8.5%) and poorly controlled DM (HbA1c $>$ 8.5%). Patients with poorly and well controlled DM were further grouped into subgroups depending on the level of oral hygiene. For each patient, during the clinical examination, periodontal parameters were determined: plaque index (PI), sulcus bleeding index (SBI), the level of junctional epithelium (LJE) and periodontal pocket depth (PPD).

Results The results showed that patients with well controlled disease and good oral hygiene had lower values of the examined periodontal parameters (SBI and PPD) than patients with poorly controlled DM and worse oral hygiene ($p<0.01$ for SBI, $p<0.05$ for PPD).

Conclusion The results of this study indicate the important role of oral hygiene for periodontal status of patients with DM.

Keywords: periodontal diseases; oral hygiene; diabetes mellitus

INTRODUCTION

Periodontal disease and diabetes mellitus (DM) are among the most common chronic diseases of our time. Therefore, biological connection between them is possible [1]. Research on biological relationship between DM and periodontal disease confirmed that hyperglycemia leads to increased immune-inflammatory response to periodontal pathogens [2] resulting in faster and more intensive destruction of periodontal tissue.

It is known that periodontitis is one of the most common oral diseases in patients having DM and the prevalence, severance and progression of periodontitis is greater in patients with DM [3]. Determination of the glucose blood level and the level of glycosylated hemoglobin (HbA1c) in blood is necessary for the diagnosis and monitoring of patients with DM. Hyperglycemia and poor metabolic control increase number of diabetic complications such as retinopathy and nephropathy [4]. Also, the level of glucose can affect the condition of periodontal tissue. Studies have shown that patients with poorly controlled DM have three times greater risk of developing periodontitis compared to patients without DM [5]. Poor control of glucose level in patients with DM is accompanied with increased loss of junctional epithelium and

alveolar bone [6, 7]. On the other hand, there are studies that did not show the existence of significant link between the control of glucose level and periodontal tissue condition [8, 9].

Oral hygiene habits play a significant role in the maintenance and preservation of health periodontal tissue and the prevalence of periodontitis varies according to the individual's health habits. It is believed that the majority of patients with well controlled DM and good oral hygiene habits do not have increased risk of developing periodontitis compared to healthy individuals [10].

Taking these facts into account the objective of this study was to examine the influence of HbA1c level and the level of oral hygiene on periodontal health of patients suffering from DM.

MATERIAL AND METHODS

The study included 50 people with type 2 DM (23 females and 27 males), average age 57.2 ± 13.5 years, selected randomly during regular check up of at the Department for Endocrinology, Clinic of Internal Medicine, Medical Center in Foca. The study included people older than 25 years with at least 6 teeth present in both jaws.

Patients were grouped on the basis of glucose control of the disease. Values of HbA1c (not older than six months) were taken from medical records of the patients and dichotomized to $\leq 8.5\%$, where values of $\text{HbA1c} \leq 8.5\%$ represented well and $\text{HbA1c} > 8.5\%$ poorly controlled DM. Patients with poorly and well controlled DM were further grouped into subgroups depending on the level of oral hygiene. The level of oral hygiene was assessed using plaque index (PI) by Silness & L  e. The value of $\text{PI} < 2$ was considered as good oral hygiene and $\text{PI} \geq 2$ as poor oral hygiene. According to the glucose level control and the level of oral hygiene, subjects were grouped into four subgroups: patients with $\text{HbA1c} \leq 8.5\%$ and $\text{PI} < 2$ ($n=10$), patients with $\text{HbA1c} \leq 8.5\%$ and $\text{PI} \geq 2$ ($n=13$), patients with $\text{HbA1c} > 8.5\%$ and $\text{PI} < 2$ ($n=9$) and patients with $\text{HbA1c} > 8.5\%$ and $\text{PI} \geq 2$ ($n=18$).

Clinical periodontal examinations were conducted at the Dental Clinic, Faculty of Medicine, Foca, using artificial light, dental mirror and periodontal probe, according to the recommendations of the World Health Organization [11]. Periodontal parameters PI, sulcus bleeding index (SBI), the depth of periodontal pockets (PPD) and level of junctional epithelium (LJE) were determined at the four sides of all present teeth (vestibular, oral, mesial and distal).

Ethical Committee of the Faculty of Medicine in Foca has approved the conduction of the study. The respondents gave written consent before they were included in the study.

Statistical analysis was done in SPSS 11.5 software for Windows. Values of the mean and SD were calculated and significant differences between groups were determined using t-test and ANOVA. P values < 0.05 were considered statistically significant.

RESULTS

Periodontal parameters in patients who had well controlled disease ($\text{PI}=2.20$; $\text{SBI}=2.54$; $\text{LJE}=3.30$) were lower compared to patients with poorly controlled DM ($\text{PI}=2.34$; $\text{SBI}=2.60$;

Table 1. Average values of periodontal parameters in patients with well and poorly controlled diabetes mellitus (DM) type 2

Tabela 1. Prose ne vrednosti parodontalnih parametara kod ispitanika sa dobro i lo e kontrolisanim dijabetes melitusom (DM) tip 2

Parameter Parametar	Well controlled DM Dobro kontrolisan DM	Poorly controlled DM Lo�e kontrolisan DM
HbA1c (%)*	7.16±0.91	10.01±1.24
PI PI	2.20±0.74	2.34±0.54
SBI IKG	2.54±0.79	2.60±0.57
LJE NPE	3.30±1.50	3.51±1.74
PPD DPD�	5.74±0.93	5.33±0.89

* $p < 0.001$

HbA1c – glycosylated hemoglobin; PI – plaque index; SBI – sulcus bleeding index; LJE – level of junctional epithelium; PPD – periodontal pocket depth
HbA1c – glikozilirani hemoglobin; PI – plak-indeks; IKG – indeks krvarenja gingive; NPE – nivo pripojnog epitela; DPD  – dubina parodontalnog d eapa

$\text{LJE}=3.54$), but the difference was not statistically significant (Table 1). When the analysis included the level of oral hygiene, the results showed that patients with well controlled disease and good oral hygiene had lower values of the examined periodontal parameters (SBI and LJE) compared to patients with poorly controlled DM and worse oral hygiene ($p < 0.01$ for SBI and $p < 0.05$ for LJE) (Table 2). In patients with poor oral hygiene average values for SBI and LJE were significantly higher compared to patients who had better oral hygiene, independently from metabolic control of the disease. Average values of PPD in the examined subgroups were almost the same (Table 1 and 2).

DISCUSSION

The influence of DM on periodontal health was interesting topic for numerous studies. Along with other complications of DM, current literature data shows that the worse glucose control causes worse condition of periodontal tissue. Research on the relation between glucose control and periodontitis have been conducted both in patients with type 1 DM or type 2 DM or both. The authors suggest that poor control of the disease in patients with type 2 DM is significant factor associated with the deteriorating condition of periodontal tissue [12, 13, 14]. On the other hand, the results of individual studies, and this research also, do not indicate that the prevalence and severity of periodontitis is higher in those patients with poor glucose control [8, 9, 15, 16]. In fact, although the values of periodontal parameters in this study were slightly higher in patients

Table 2. Average values of periodontal parameters in patients with DM type 2 in relations to values of glycosylated hemoglobin (HbA1c) and plaque index (PI)

Tabela 2. Prose ne vrednosti parodontalnih parametara kod ispitanika sa DM tip 2 u zavisnosti od nivoa glikoziliraju eg hemoglobina (HbA1c) i vrednosti plak-indeksa (PI)

Parameter Parametar	HbA1c≤8.5%, PI<2	HbA1c≤8.5%, PI≥2	HbA1c>8.5%, PI<2	HbA1c>8.5%, PI≥2
SBI IKG	2.15±0.86	2.83±0.62	2.12±0.55	2.84±0.42
HbA1c≤8.5%, PI<2	-	$p < 0.05$	NS	$p < 0.01$
HbA1c≤8.5%, PI≥2	-	-	$p < 0.01$	NS
HbA1c>8.5%, PI<2	-	-	-	$p < 0.01$
HbA1c>8.5%, PI≥2	-	-	-	-
LJE NPE	2.68±1.47	3.78±1.39	2.52±1.71	4.01±1.57
HbA1c≤8.5%, PI<2	-	NS	NS	$p < 0.05$
HbA1c≤8.5%, PI≥2	-	-	NS	NS
HbA1c>8.5%, PI<2	-	-	-	$p < 0.05$
HbA1c>8.5%, PI≥2	-	-	-	-
PPD DPD�	5.46±0.89	5.96±0.93	5.27±0.71	5.37±0.99
HbA1c≤8.5%, PI<2	-	NS	NS	NS
HbA1c≤8.5%, PI≥2	-	-	NS	NS
HbA1c>8.5%, PI<2	-	-	-	NS
HbA1c>8.5%, PI≥2	-	-	-	-

NS – statistically not significant; NS – nije statisti ki značajno

with poorly controlled disease, this difference was not significant. One of the reasons for this discrepancy can be explained by small number of participants in this survey, but also different methodological approaches and different classifications of poor and well-controlled disease on the basis of the value of HbA1c. In this study, the HbA1c value was dichotomized at the value of 8.5% for the group of well and poorly controlled DM, according to the guidelines of the Croatian and Finnish Society for DM [17]. It should be also considered that there is an individual variation regarding the effect of glucose level on periodontal tissue. In multifactorial nature of periodontitis, systemic diseases do not have primary role, they have more modifying role [1]. There is also a view that DM by itself does not cause gum disease, but has a role in modifying gingival-periodontal space and thus can facilitate the development of periodontal disease when primary factor for diseases- bacterial plaque is present [18, 19].

When the analysis included the factor of oral hygiene, PI, the results of this investigation showed SBI and LJE values significantly higher in patients with poorly controlled DM and lower level of oral hygiene compared to group of patients with well controlled disease and good oral hygiene. This indicates that both factors can have a significant impact on the state of periodontal tissue. A significant difference is found in values of SBI and LJE in patients with poor oral hygiene in comparison to patients with lower values of PI, regardless of the degree of metabolic control of the disease.

Continuos food intake in order to maintain normal glucose level in patients with DM facilitates the increase in dental plaque and the development of diseases such as caries and periodontitis. Research results of Bakhshandeh et al. [20] indicated a significant impact of the value of PI on periodontitis in patients with DM and suggested oral-hygiene instructions for such patients. A recent meta-analysis conducted in order to determine the relationship between the DM and periodontal tissue disease showed that patients with DM have worse oral hygiene, severe gum and periodontal tissue disease than patients without DM [21]. However, the authors found that there was no difference in oral hygiene, gum and periodontal tissue disease between patients with DM and without DM, based on the analysis of periodontium affected by periodontal disease.

CONCLUSION

Beside the limitations of the study, results showed that for periodontal status of patients with DM oral hygiene plays a significant role. Intensive programs of health education and promotion of oral health are of great importance in people with DM. The treatment of oral diseases in DM patients is not much different from the one conducted in patients without DM, but in patients with DM (especially those with poorly controlled disease and oral infections)

strict monitoring, intensive and aggressive treatment as well as sensitive approach in diagnosis of acute oral infections is needed.

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Stanje parodonticijuma osoba obolelih od dijabetes melitusa u odnosu na nivo glikoziliranog hemoglobina i oralnu higijenu

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KRATAK SADRŽAJ

Uvod Parodontopatija je jedno od najčešćih oboljenja oralne regije kod osoba obolelih od dijabetes melitusa (DM). Cilj ovog istraživanja je bio da se ispita uticaj nivoa glikoziliranog hemoglobina (HbA1c) i stepena oralne higijene na stanje parodonticijuma bolesnika sa DM.

Materijal i metode rada Ispitano je 50 osoba sa DM tip 2 koje su odabrane metodom slučajnog uzorka. Na osnovu vrednosti HbA1c, ispitanici su svrstani u dve grupe: prvu grupu su činili bolesnici koji su dobro kontrolisali DM (HbA1c ≤ 8,5%), a drugu bolesnici s loše kontrolisanim DM (HbA1c > 8,5%). Ispitanici dve grupe su dalje podeljeni u podgrupe u zavisnosti od stepena oralne higijene. Svakom bolesniku su prilikom kliničkog pregleda određene vrednosti parodontalnih parametara: plak-indeksa (PI), indeksa krvarenja gingive (IKG), nivoa pripojnog epitela (NPE) i dubine parodontalnog džepa (DPDŽ).

Rezultati Dobijeni rezultati su pokazali da su kod bolesnika sa dobro kontrolisanim oboljenjem i dobrom oralnom higijenom vrednosti ispitivanih parodontalnih parametara (IKG i NPE) niže nego kod bolesnika s loše kontrolisanim DM i lošijom oralnom higijenom ($p < 0,01$ za IKG; $p < 0,05$ za NPE).

Zaključak Rezultati ovog istraživanja ukazuju na značajnu ulogu oralne higijene na stanje parodonticijuma osoba sa DM.

Ključne reči: parodontopatija; oralna higijena, dijabetes melitus

UVOD

Parodontopatija i dijabetes melitus (DM) su danas među najčešćim hroničnim oboljenjima i između njih postoji biološka povezanost [1]. Istraživanja o ovoj vezi potvrđuju da DM i hiperglikemija vode ka povećanom imunoinflamatornom odgovoru na parodontalne patogene, izazivajući brže i intenzivnije uništavanje parodontalnog tkiva [2].

Parodontopatija je jedno od najčešćih oboljenja oralne regije osoba sa DM, a prevalencija, težina i napredovanje parodontopatije veći su kod ovih bolesnika [3]. Određivanje nivoa glikoze i glikoziliranog hemoglobina (HbA1c) u krvi je neophodno za dijagnostikovanje DM i kliničko praćenje njegovog razvoja. Hiperglikemija i loša metabolička kontrola izazivaju povećanje broja komplikacija DM, kao što su retinopatija i nefropatija [4]. Nivo glikemijske kontrole može da utiče i na stanje potpornog aparata zuba. Istraživanja su pokazala da je kod bolesnika s loše kontrolisanim DM rizik od nastanka parodontopatije tri puta veći u poređenju sa bolesnicima bez DM [5]. Loša glikemijska kontrola kod bolesnika sa DM praćena je i povećanim gubitkom pripojnog epitela i alveolarne kosti [6, 7]. S druge strane, ima studija koje ne pokazuju značajnu vezu između glikemijske kontrole i stanja parodonticijuma [8, 9].

Oralnohigijenske navike imaju značajnu ulogu u održavanju i očuvanju zdravlja potpornog aparata zuba, a prevalencija parodontopatija varira u zavisnosti od zdravstvenih navika svake osobe. Smatra se da kod većine bolesnika sa dobro kontrolisanim DM i dobrim oralnohigijenskim navikama ne postoji povećan rizik od razvoja parodontopatije u poređenju sa zdravim osobama [10].

Uzimajući ove činjenice u obzir, cilj ovoga istraživanja je bio da se ispita uticaj nivoa HbA1c i stepena oralne higijene na stanje parodonticijuma osoba obolelih od DM.

MATERIJAL I METODE RADA

Ispitano je 50 osoba sa DM tip 2 (23 žene i 27 muškaraca), prosečne starosti od $57,2 \pm 13,5$ godina, koje su izabrane metodom slučajnog uzorka prilikom redovnog endokrinološkog pregleda na Odeljenju interne medicine Kliničkog centra u Foči. U istraživanje su uključeni bolesnici stariji od 25 godina koji imaju barem šest zuba u obe vilice.

Grupisanje ispitanika je izvršeno na osnovu glikemijske kontrole oboljenja. Vrednosti HbA1c (nalaz ne stariji od šest meseci) dobijene su iz medicinske dokumentacije bolesnika i dihotomizirane na 8,5%, pri čemu je nivo HbA1c od 8,5% i manji predstavljao dobro kontrolisani DM (prva grupa ispitanika), a nivo veći od 8,5% loše kontrolisani DM (druga grupa ispitanika). Ispitanici obe grupe su dalje svrstani u podgrupe u zavisnosti od stepena oralne higijene. Za ovu procenu primenjen je plak-indeks (PI) po Silnes-Louu (*Silness-Löe*), pri čemu su se vrednosti PI manje od 2 smatrale pokazateljem dobre, a vrednosti veće od 2 pokazateljem loše oralne higijene. Ispitanici su svrstani u četiri podgrupe: prvu je činilo 10 bolesnika sa HbA1c ≤ 8,5% i PI < 2, drugu 13 bolesnika sa HbA1c ≤ 8,5% i PI ≥ 2, treću devet bolesnika sa HbA1c > 8,5% i PI < 2, a četvrtu 18 bolesnika sa HbA1c > 8,5% i PI ≥ 2.

Klinički parodontološki pregledi ispitanika obavljani su na Stomatološkoj klinici Medicinskog fakulteta u Foči prema preporukama Svetske zdravstvene organizacije [11]. Parodontalni parametri PI, indeks krvarenja gingive (IKG), dubina parodontalnog džepa (DPDŽ) i nivo pripojnog epitela (NPE) određeni su merenjem sa četiri strane (vestibularne, oralne, mezialne i distalne) svih zastupljenih zuba.

Etički komitet Medicinskog fakulteta u Foči odobrio je izvođenje ove studije, a ispitanici su dali pisanu saglasnost pre uključivanja u studiju.

Statistička obrada podataka urađena je u programu SPSS 11.5 za Windows. Izračunate su srednje vrednosti i standardna devijacija, a značajnost razlike između grupa određena je primenom Studentovog t-testa i ANOVA. Vrednosti p manje od 0,05 smatrale su se statistički značajnim.

REZULTATI

Analizom vrednosti parodontalnih parametara u zavisnosti od metaboličke kontrole oboljenja utvrđeno je da su one nešto manje kod ispitanika sa dobro kontrolisanim DM (PI=2,20; IKG=2,54; NPE=3,30) u poređenju sa ispitanicima sa loše kontrolisanim oboljenjem (PI=2,34; IKG=2,60; NPE=3,54), ali ta razlika nije bila statistički značajna (Tabela 1). Kada je u analizu uključen i stepen oralne higijene, nalazi su pokazali da su kod bolesnika sa dobro kontrolisanim DM i dobrom oralnom higijenom manje vrednosti ispitivanih parodontalnih parametara (IKG i NPE) u odnosu na bolesnike sa loše kontrolisanim oboljenjem i lošijom oralnom higijenom ($p < 0,01$ za IKG; $p < 0,05$ za NPE) (Tabela 2). Kod ispitanika sa lošijom oralnom higijenom prosečne vrednosti IKG i NPE su bile značajno veće u poređenju sa bolesnicima koji imaju bolju oralnu higijenu, nezavisno od metaboličke kontrole oboljenja. Prosečne vrednosti DPDŽ u ispitivanim podgrupama bile su približno iste (Tabele 1 i 2).

DISKUSIJA

Uticaj DM na parodontalno zdravlje bila je tema mnogih naučnih istraživanja. Zajedno s ostalim komplikacijama DM, aktuelni podaci iz literature pokazuju da loša glikemijska kontrola utiče i na loše stanje parodonticijuma. Istraživanja o vezi između glikemijske kontrole i parodontopatije su izvedena i na bolesnicima sa DM tip 1, i sa DM tip 2. Autori ukazuju na to da je loša kontrola oboljenja kod ispitanika sa DM tip 2 značajan faktor koji je povezan s lošim stanjem potpornog aparata [12, 13, 14]. S druge strane, rezultati pojedinih studija, kao i ovog istraživanja, ne pokazuju da je prevalencija i težina parodontopatije veća kod bolesnika s lošom glikemijskom kontrolom [8, 9, 15, 16]. Naime, iako su vrednosti parodontalnih parametara u ovom istraživanju bile nešto veće kod ispitanika s loše kontrolisanim DM, ta razlika nije bila statistički značajna. Ovakav nalaz se može objasniti manjim uzorkom ispitanika u ovom istraživanju, postojanjem različitih metodoloških pristupa i različitim klasifikacijama loše i dobro kontrolisanog oboljenja na osnovu nivoa HbA1c. U ovom istraživanju prosečna vrednost HbA1c je dihotomizirana na 8,5% za grupisanje ispitanika sa

dobro i loše kontrolisanim DM, prema smernicama hrvatskog i finskog Društva za DM [17]. Takođe se smatra da postoji individualna varijabilnost o uticaju stepena glikemijske kontrole na stanje parodonticijuma, tako da u multifaktorskoj prirodi parodontopatije sistemska oboljenja imaju pre modifikujuću, nego primarnu ulogu [1]. Smatra se i da DM sam po sebi ne uzrokuje oboljenje desni, ali ima ulogu u modifikaciji gingivo-parodontalnog prostora, čime olakšava razvoj parodontalnog oboljenja kada je zastupljen primarni faktor oboljenja – bakterijski plak [18, 19].

Kada je u analizu uključen i faktor koji određuje stepen oralne higijene, odnosno PI, rezultati istraživanja su otkrili da su vrednosti IKG i NPE značajno veće kod bolesnika s loše kontrolisanim DM i lošijom higijenom usta i zuba u odnosu na bolesnike sa dobro kontrolisanim oboljenjem i dobrom oralnom higijenom. Ovo ukazuje na to da oba ispitivana faktora mogu značajno uticati na stanje parodonticijuma. Takođe, uočena je značajna razlika u vrednostima IKG i NPE kod ispitanika s lošijom oralnom higijenom u odnosu na ispitanike sa manjim vrednostima PI, bez obzira na stepen metaboličke kontrole oboljenja.

Potreba za stalnim unošenjem hrane radi regulacije nivoa šećera kod bolesnika sa DM olakšava povećanje dentalnog plaka i razvoj oboljenja, kao što su karijes i parodontopatija. Rezultati istraživanja Bakšandea (*Bakhshandeh*) i saradnika [20] ukazuju na značajan uticaj vrednosti PI na parodontopatiju kod osoba sa DM i na potrebu za oralnohigijenskim savetima kod ovih bolesnika. Metaanaliza koja je nedavno izvedena sa ciljem da se odredi veza između oboljenja parodonticijuma i DM pokazuje da bolesnici sa DM imaju lošiju oralnu higijenu i izraženija oboljenja desni i parodonticijuma nego osobe koje ne boluju od DM [21]. Ipak, autori su ustanovili da nema razlike u oralnoj higijeni i oboljenjima desni i parodonticijuma između ispitanika sa DM i bez DM kada se analiza vrši na osnovu mesta koja su zahvaćena parodontalnim promenama.

ZAKLJUČAK

Pored ograničenja, rezultati ovoga istraživanja pokazuju da na stanje parodonticijuma bolesnika sa DM značajno utiče stepen oralne higijene. Ovo ukazuje na potrebu za intenzivnim programima zdravstvenog vaspitanja i promocije oralnog zdravlja osoba obolelih od DM. Lečenje oboljenja usta i zuba bolesnika sa DM se ne razlikuje mnogo od onog koje se primenjuje kod drugih osoba, ali su kod ovih bolesnika (posebno onih s loše kontrolisanim oboljenjem i oralnim infekcijama) potrebni strogo kliničko praćenje stanja, intenzivniji i agresivniji tretman i osetljiviji pristup dijagnostici akutnih oralnih infekcija.