

Correlation between Glycated Hemoglobin Level and Clinical Parameters of Periodontal Disease in Type 2 Diabetes Mellitus

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ABSTRACT

Objective

To correlate between Glycated Hemoglobin (HbA1c) level and clinical parameters of Periodontal Disease in Type 2 Diabetes Mellitus (T2DM) patients.

Methodology

This comparative study was performed from November 2015 to May 2016 in Peshawar. Total of 56 participants suffering from T2DM and periodontal disease were included in the study. All participants were examined for periodontitis by using four parameters Wiesbaden –Germany “ kit. SPSS version 20 was used for data analysis.

Results

Among 56 subjects, 39.3% had good glycemic control with HbA1c in range of 6.1-7.0, whereas 60.7% had uncontrolled diabetes with HbA1c of more than 7.0. In terms of Papillary Bleeding Index (PBI) score, the controlled (HbA1c =6.1-7.0) and uncontrolled diabetes groups (HbA1c>7) differed significantly (Chi-Square test $p=0.013$). Similarly both the groups differed significantly in terms of Mean Periodontal Disease Index (PDI) ($p=0.038$, at significant level of $p<0.05$) and Periodontal Pocket Depth (PPD) (p -value measured by the t-test $p=0.022$). Mean number of missing teeth due to periodontal disease was noted as 4.88 ± 1.42 in uncontrolled diabetes group and 2.82 ± 1.26 in controlled diabetes ($p=0.29$). A strong significant positive correlation of HbA1c level with PBI ($r_s=0.595$), PDI ($r_s=0.578$) and PPD ($r_s=0.680$) was found. However a weak but significant correlation ($r_s=0.289$, $p=0.041$) was also found between HbA1c level and number of lost teeth due to periodontal disease.

Conclusion

We concluded that significant correlation exists between Glycated Hemoglobin (HbA1c) level and clinical parameters of Periodontal Disease in Type 2 Diabetics.

Key words: Type 2 Diabetics, Periodontal disease, Glycated hemoglobin

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INTRODUCTION

Diabetes mellitus and periodontal disease are among the most diagnosed pathologies encountered in practice. Both conditions frequently co-exist and the prevalence of periodontal disease in patients with diabetes mellitus is higher than in general population.¹ Glycated hemoglobin (HbA1C) is the best measure of long duration glycemic control since it reveals the average level of blood glucose over the duration of quite a few months.² Glycemic control is demarcated as excellent if HbA1c is < 6.5 %; very good if HbA1c is between 6.5 and 7 %, good if glycated hemoglobin is 7.1 to 7.5 % and poor if HbA1c is > 8.0 %.³

Several studies have proved that HbA1c is associated with the severity of periodontitis.⁴ Others reported that there is no alteration in the periodontal status of diabetics with good glycemic control and non-diabetics.⁵

Prevalence and severity of the periodontitis is reduced by the maintenance of the normal blood glucose level. Several factors have been suggested to highlight the raised frequency of periodontitis in diabetics involving the alteration in sub gingival micro flora, host response and wound healing.⁶

Patients with uncontrolled diabetes are prone to salivary disorders. Reduced salivary flow rate causes alterations in the

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basement membrane of the salivary glands. Further, diabetics on medications have significant xerostomic effect. These effects may also lead to the progress of periodontal disease.⁷ Poor glycemic control is highly related to defective Polymorphonuclear leukocytes (PMNs) function. Polymorphonuclear leukocytes make the first-line-of-defense. Their impaired function cause high susceptibility of infections in diabetics.⁸

Taboza *et al.* reported that uncontrolled diabetes have 3.9 fold higher risk for having periodontitis in comparison to the subjects with normo-glycemia. Good glycemic control reduces the risk for periodontitis.⁹ Rohani B have found in a study, that patients with poorly controlled diabetes had more attachment loss throughout the mouth than did patients with good to moderately controlled diabetes. Additionally, the periodontal involvement of patients with good to moderately controlled diabetes was similar to that of patients without diabetes.¹⁰

Objectives of our study was to explore an association between type 2 diabetes mellitus (T2DM) and severity level in terms of clinical parameters of periodontal disease. i.e. papillary bleeding index (PBI); periodontal disease index (PDI), pocket depth (PD) and number of missing teeth and to establish correlation of severity level of periodontal disease with the HbA1c level in T2DM.

METHODOLOGY

This present comparative study is a part of a larger study that was conducted in 3 teaching hospitals of Peshawar including Prime Teaching hospital, Peshawar Dental hospital and Sardar Begum Dental hospital. It was a case control study in which participants suffering from T2DM and periodontal disease were recruited as cases. Participants suffering from periodontal disease but not having diabetes were included as controls. Age range was set to be 40-65 years. Exclusion criteria were pregnancy, smoking, hypertension and Type 1 Diabetes Mellitus. The study was approved by the ethical committee of the Peshawar Medical College. (Prime/IRB/2021-426).

Required sample size for this study was calculated to be 50 with 95% confidence level, two-sided significance level (α) of 0.05 to detect the odds ratio (OR) of 5.5 derived from former research¹¹. The final sample comprised of 56 participants suffering from T2DM. The sampling technique was purposive sampling. The study participants (n=56) were compared in terms of HbA1c level and severity of periodontal disease.

All the participants were clinically examined for periodontal disease through periodontal disease index (PDI), papillary bleeding index (PBI) and pocket depth (PD) and number of missing teeth. HbA1c was determined by using "Human Gmbh –Max –Planck –Ring 21 -65205 Wiesbaden –Germany " kit. Blood was taken from ante cubital fossa of subjects under aseptic technique. HbA1c determination was carried out on EDTA anti coagulated blood. Patients were in semi supine position on dental unit during examination. PBI¹², PDI¹³ and PD¹⁴ of all the participants were calculated on six Ramphored teeth, 16 (maxillary right first molar),

21 (maxillary central incisor), 24 (maxillary left premolar), 36 (mandibular left first molar), 41 (mandibular right central incisor), 44 (mandibular right premolar) during dental examination. The instruments used were mouth mirror, periodontal probe and WHO probe. HbA1c reflects the average blood glucose level of the last 3 to 4 months and is stable for the life of the erythrocytes, and provides a very valuable test for assessing the long term control of diabetics. SPSS version 20 was used for data analysis.

RESULTS

Among 56 subjects, 39.3% (22) had controlled diabetes with HbA1c level ranging between 6.1 and 7.0, whereas 60.7% had uncontrolled diabetes with HbA1c level of more than 7. The recorded mean Papillary Bleeding Index (PBI) score was 2.23±0.83 in uncontrolled diabetes group and 1.73±0.52 in controlled diabetes. *p*-value, measured by "Chi-Square "test was significant (*p*=0.013).

Mean Periodontal Disease Index (PDI) score was marked 1.94(±0.45) in uncontrolled diabetes group (HbA1c>7) and 1.50 (± 0.31) in controlled diabetes (HbA1c =6.1-7.0). *P*-value, measured by Chi-Square test was found significant. (*p*=0.038, at significant level of *p*<0.05). Mean Periodontal Pocket Depth of 4.08±1.28 mm was observed in uncontrolled diabetics (HbA1c>7) and 3.12±1.08 mm in controlled diabetics (HbA1c=6.1-7.0). *P*-value measured by the *t*-test was found significant (*p*=0.022). Mean number of missing teeth due to periodontal disease was noted as 4.88±1.42 in uncontrolled diabetes group (HbA1c>7) and 2.82±1.26 in controlled diabetes (HbA1c =6.1-7.0) (*p*= 0.29). Table 1.

Parameters	HbA1c levels		<i>p</i> -Values
	controlled diabetes(6.1-7.0) (n=22)	uncontrolled diabetes(>7) (n=34)	
Papillary Bleeding Index(PBI) Score	1.73±0.52	2.23±0.83	a0.014*
Pocket depth Score	1.50±0.31	1.94±0.45	a0.038 *
Periodontal Disease Index(PDI) Score	3.12±1.08	4.08±1.65	b0.022 *
number of missing teeth	2.82±1.26	4.88±1.42	b0.29NS

a=*P* value measured by Chi-Square test, *b*=*P* value measured by *t* test, *=significant(significance level *p*<0.05), NS=Non-significant(significance level *p*>0.05)

Table 1 showing Glycated Hemoglobin levels, Papillary bleeding Index, Periodontal Disease Index, Periodontal Pocket Depth (PPD), number of missing teeth in Periodontal disease in subjects(n = 56)

Spearman correlation test was performed to find the correlation between glycated Hb level and the clinical parameters of periodontal disease. We found a strong significant correlation of HbA1c level with Papillary Bleeding Index (*r*_s=0.595), Periodontal Disease Index (*r*_s=0.578) and Periodontal Probing Depth

($r_s=0.680$). However a weak but significant correlation ($r_s=0.289$, $p=0.041$) was also found between HbA1c level and number of lost teeth due to periodontal disease. Table 2.

These results have showed that all the clinical parameters of periodontal disease displayed high values in the uncontrolled diabetes group. However, the difference between the two groups in the means value was significant in case of Papillary Bleeding Index ($p=0.013^*$), Periodontal Disease Index (0.038^*), Periodontal Pocket Depth (0.022^*) but not in the number of missing teeth (0.29^{NS}) (table 1).

Parameters	Glycated Hemoglobin (HbA1c) level	
	r_s	p -values
Papillary Bleeding Index (PBI)	0.595	.000*
Periodontal Disease Index (PDI)	0.578	.000*
Periodontal Probing Depth	0.680	.000*
No of missing teeth due to periodontal	0.289	.041*

r_s =spearman's rank correlation coefficient, *=significant (significance level $p<0.05$)

Table 2: Correlation between Glycated Hemoglobin (HbA1c) level And Clinical Parameters of Periodontal Disease in Type 2 Diabetes Mellitus patients (n = 56)

DISCUSSION

The cases with type 2 diabetes mellitus were categorized in two groups i.e. uncontrolled diabetes ($HbA1c>7$) and controlled diabetes ($HbA1c=6.1-7.0$). A one-time determination of glycated hemoglobin was carried out as by the study of Singh *et al.*¹⁵

Similar to our findings, Sanz M *et al.* in a study have found that a significant association exists between the HbA1c level and Periodontal disease. Pocket depth was reported to be significantly higher ($p<0.05$) in uncontrolled group than the controlled diabetes group.¹⁶ In another study at Karachi by Tanwir *et al.*, the periodontal status of uncontrolled diabetics was significantly different (poor) than that of controlled diabetics ($p<.001$).¹⁷ Although a level of $HbA1c\leq 7.5$ was used to define controlled diabetics.

Awad *et al.*, in a study at Oman have found the HbA1c level to had a significant association with gingival bleeding and periodontal pockets.¹⁸ Patil *et al.*, also found the increased severity of periodontal disease in cases with high HbA1c levels.¹⁹ Raju, K *et al.*, reported more missing teeth in diabetics with high HbA1c level.²⁰

The insignificant difference between the controlled and uncontrolled diabetes group in our study may be attributed to the effect of duration of diabetes. The two groups were not matched in terms of this factor. Madianos *et al.* demonstrated that duration of diabetes has an important effect on the number of missing

teeth in diabetics.²⁰

Jindal *et al.* explored the correlation between the levels of glycated hemoglobin and severity level of periodontal disease in fifty type I diabetes mellitus patients. The results, similar to the our study demonstrated that the higher level of HbA1c (poor glycemic control) will cause an increase in the severity level of periodontal disease.²² However in that study the diabetics were divided into three groups whereas we divided the diabetic in two groups. Although they didn't use Papillary Bleeding Index(PBI) but used Gingival Index to evaluate the status of gingival papilla in the subjects.

Kassab *et al.*, like our study, also documented that the levels of glycated hemoglobin effect the severity of periodontal disease. In addition to recording clinical parameters of periodontal disease they also measured salivary interleukins and assessed the pathogens in the saliva of study participants.²³ Stoicescu *et al.* also found similar results in a study conducted at Romania.²⁴ A retrospective cohort study conducted by Costa *et al* even suggested a bi-directional relationship between the periodontal disease and levels of glycated hemoglobin.²⁵

CONCLUSION

We concluded that significant correlation exists between Glycated Hemoglobin (HbA1c) level and four clinical parameters of Periodontal Disease in Type 2 Diabetes Mellitus patients

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