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"Assessing the Influence of Glycated HemoglobinLevelson Periodontal Status of DiabeticPatients- A Clinicaland Radiographic Study"

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ABSTRACT: OBJECTIVES*: To evaluate the influence of glycated haemoglobin levels onthe periodontal status of diabetic patients by assessing clinical parameters and radiographic bone loss.*
METHODOLOGY*: A total of 30 diabetic patients were selected. Patients were divided into three groups,Group1: 10systemically healthy patients with periodontitis,Group2:10 adequately-controlled diabetic subjects with HbA1c<7 %, and Group3:10 inadequately-controlleddiabetic subjects with HbA1c>7%.Clinical parameters [Plaqueindex,Gingival index, andProbingPocket depth] and radiographic bone loss were assessed.*

RESULT*: The average plaque index and gingival index score were higher in the chronic periodontitis group, while AT2D and IT2D had no significant difference whereas Probing pocket depth and bone loss considering the number of sites was higher in systemically healthy chronic periodontitis patients compared to diabetic groups, whereas between two diabetic groups, AT2D had slightly more average scores than IT2D.*

CONCLUSION: *The analysis between the two diabetic groups states that there is no significant difference in average pocket depth and bone loss, proving that an increase in levels of HbA1C alone is not a determining factor in assessing the periodontal status.*

KEYWORDS*:Alveolar bone loss,Chronic periodontitis, Diabetes mellitus, Glycated Hemoglobin, Probing pocket depth.*

I. INTRODUCTION:

Chronic systemic diseases such as cardiovascular diseases, cancer, diabetes, and chronic respiratory conditions are the predominant causes of mortality worldwide, accounting for 71% of global deaths. These conditions pose a substantial burden on global health. Similarly, inflammatory periodontal diseases like gingivitis and periodontitis, which impact the tissues supporting the teeth, are widespread and have established connections with other non communicable diseases and disorders. This includes diabetes, heart disease, lung disease, rheumatoid arthritis, kidney disease, and cognitive decline. The association is through various credible

mechanisms and pathways, including infection (like bacteremia), inflammation, microbial imbalance, and shared risk factors [1].

Diabetes mellitus consists of a group of metabolic disorders characterized by elevated blood glucose levels due to resistance to insulin action, insufficient insulin secretion, or both, and is associated with abnormalities in the metabolism of carbohydrates, fats, and proteins.According to the Indian Council of Medical Research – India Diabetes (ICMR INDIAB) study, 10.1 crores (101 million) people live with diabetes. This represents about 11.4% of the country's population. Additionally, there are at least 136 million people, or 15.3% of the population, who have prediabetes[2].

Periodontal disease is often referred to as the sixth complication of diabetes, alongside retinopathy, nephropathy, neuropathy,and impaired wound healing. Additionally, periodontitis appears to increase the risk of developing diabetes [3].There is a two-way inflammatory relationship between periodontitis and diabetes mellitus (DM). Diabetes impacts all aspects of periodontal health, such as probing pocket depth, clinical attachment level, and loss of alveolar bone. Periodontitis contributes to the overall inflammatory burden in the body by permitting the passage of bacteria, cytokines, and inflammatory mediators through the compromised epithelial lining of periodontal pockets [4].This inflammatory reaction from periodontitis exacerbates insulin resistance [5].

Maintaining meticulous oral hygiene can reduce oral inflammation and slow down periodontal degradation in diabetic patients. Regular toothbrushing and dental visits have been associated with a 34% decrease and a 32% decrease in the prevalence of periodontitis, respectively. Conversely, inadequate oral hygiene significantly raises the risk of periodontitis by 2 to 5 times [6]. Studies indicate that individuals with type 2 diabetes who practice good oral hygiene, including regular toothbrushing, typically experience improved glycaemic control and exhibit enhanced oral health as assessed by healthcare professionals [7].

Currently, diabetes mellitus is diagnosed by evaluating blood glucose levels, however, monitoring glycated haemoglobin levels is a frequent and relatively accurate measure of average glycaemic control.Glucose can irreversibly bind to haemoglobin through a non-enzymatic reaction, resulting in the formation of glycosylated haemoglobin (HbA). HbA1c, the major subfraction of HbA, reflects glycaemic control over the previous 1 to 3 months due to its dependence on the average lifespan of erythrocytes [8]. Numerous studies have highlighted the significant impact of glycated hemoglobin levels on the severity of periodontal disease.

The current research was conducted to examine how levels of glycated haemoglobin affect the periodontal health of individuals with diabetes, through the evaluation of clinical indicators and the extent of bone loss observed in radiographs. The assessment of periodontal health included measuring the depth of periodontal pockets, determining bone loss through orthopantomograms (OPG), and recording both plaque and gingival indices.

II. Materials and Methods:

Study design and sample:

For the study,Participants diagnosed with diabetes and concurrent chronic periodontitis were enlisted from the Endocrinology Department of JJMC, Davangere, Karnataka. Concurrently, individuals presenting with chronic periodontitis but without systemic health issues were engaged from the Outpatient Department of Periodontology at the College of Dental Sciences, Davangere, Karnataka. Prior to their participation, all volunteers were provided with a comprehensive oral explanation of the study's objectives, ensuring informed consent.

The study's eligibility criteria were outlined as follows:

Inclusion Criteria:

- Subjects must be older than 35 years.
- Subjects who are confirmed witha diagnosis of type II diabetes for more than 3 years.
- Subjects with chronic periodontitis.

Exclusion Criteria:

- Use of antibiotics within the last 3 months.
- Pregnant and lactating mothers.
- Individuals who engage in tobacco smoking.

The study enrolled 30 participants, categorized into three distinct groups:

- **Group 1:** Comprised of 10 individuals diagnosed with chronic periodontitis.
- **Group 2:** Included 10 subjects with diabetes, demonstrating adequate glycaemic control, as evidenced by an HbA1c level of less than 7%, in addition to chronic periodontitis. [AT2D]
- **Group 3:** Consisted of 10 participants with diabetes, characterized by inadequate glycaemic control, with an HbA1c level exceeding 7%, alongside chronic periodontitis. [IT2D]

CLINICAL EXAMINATION:

Plaque and gingival index were assessed considering the mesial, labial(buccal),distal, and lingual surfaces of assigned index teeth. PPD (probing pocket depth) was determined using a William periodontal probe, which was defined, as the distancebetween the gingival margin and the bottom of the likely pocket. PPD measurements were determined at six separate sites of all present teeth (mesiobuccal, mid-buccal, distobuccal, mesiolingual, mid-lingual, and distolingual) except for the third molars.

RADIOGRAPHIC EXAMINATION:

A digital method of estimating alveolar bone height on panoramic radiographs using 3X magnification was employed using constant anatomic landmarks as reference points - CEJ and alveolar crest. Bone loss is considered when the distance from the CEJ to the alveolar crest exceeds 2mm [9,10]. Radiographic images were interpreted by one examiner - a dental radiologist in the Department of Radiology.The total bone loss was calculated considering the number of sites of bone loss.

GLYCATED HEMOGLOBIN:

HbA1c was measured in the HINDLABS, C G Hospital, Davangere. It was measured using a high-performance liquid chromatography (HPLC) test.

STATISTICAL ANALYSIS:

The statistical analysis was conducted with SPSS statistical software. Categorical variables, referred to as quality variables, were presented as frequencies, while quantitative variables were expressed in terms of their mean and standard deviation (SD)**.** The comparison of continuous variables across four distinct groups was performed through a one-way analysis of variance (ANOVA)**.**

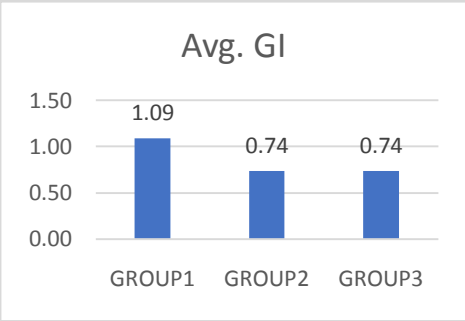
III. RESULTS:

The research included 30 participants, all of whom were diagnosed with periodontitis with and without diabetes. Measurements such as probing pocket depth, plaque index, and gingival index exhibited variation across the different groups. The statistical analysis for average plaque index and gingival index score is higher inthe

systemically healthy chronic periodontitis groupthan inthe diabetic group whereas, between the two diabetic groups, there was not much difference with a P value=0.637 >0.05. It implies there is no significant difference between study groups w.r.t Plaque Index. The average values ofprobing pocket depth and the radiographic bone loss considering the number of sites, its slightly higher in the systemically healthy chronic periodontitis group,whereas between the two diabetic groups,there was no significant statistical difference P value=0.886 >0.05. It implies there is no significant difference between study groups.

GROUPS	Avg. PI	Avg. GI	Avg. PPD	Avg. Boneloss
GROUP 1	1.32	1.09	2.20	2.23
GROUP 2	1.23	0.74	1.80	1.80
GROUP 3	1.12	0.74	1.80	1.85

Table1: Average values of clinical parameters.



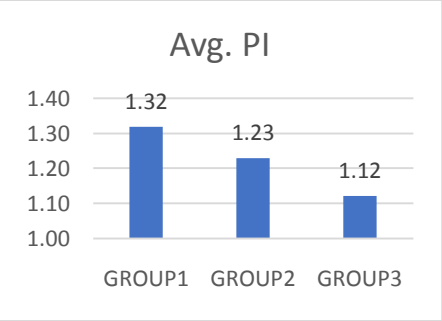
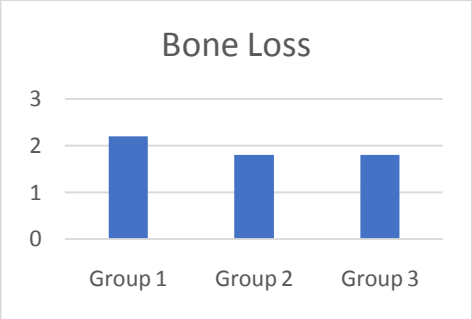


FIGURE 1 **FIGURE 2**



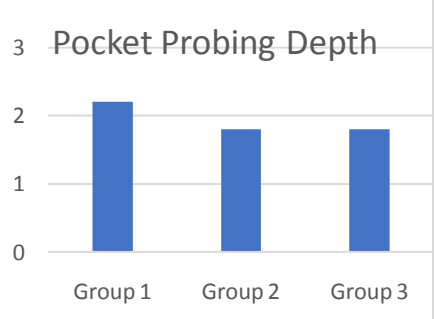


FIGURE 3 **FIGURE 4**

FIGURE 1: Graph explaining average gingival index score valuescomparing three groups.

FIGURE 2: Graph explaining average plaque index score valuescomparing three groups.

FIGURE 3: Graph explaining average bone loss comparing three groups.

FIGURE 4: Graph explaining the average probing pocket depth comparing three groups.

TABLE 2: Descriptive analysis showing the variation between groups.

CLINICAL PARAMETERS		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
PLAQUE INDEX	TOTAL	30	1.2240	0.44987	0.08213	1.0560	1.3920	0.25	2.20
GIGIVAL INDEX	TOTAL	30	0.8523	0.41137	0.07511	0.6987	1.0059	0.20	1.76
PPD	TOTAL	30	5.7333	0.69149	0.12625	5.4751	5.9915	5.00	7.00
BONE LOSSS	TOTAL	30	1.5333	0.50742	0.09264	1.3439	1.7228	1.00	2.00

TABLE 3: Analysis of variance.[ANOVA]

CLINICAL PARAMETERS		Sum of Squares	df	Mean Square	F	Sig.
Plaque Index	Between Groups	0.193	2	0.096	0.458	0.637
	Within Groups	5.677	27	0.210		
	Total	5.869	29			
Gingival index	Between Groups	0.826	2	0.413	2.732	0.083
	Within Groups	4.082	27	0.151		
	Total	4.908	29			
PPD	Between Groups	2.067	2	1.033	2.364	0.113
	Within Groups	11.800	27	0.437		
	Total	13.867	29			
BONE LOSS	Between Groups	0.067	2	0.033	0.122	0.886
	Within Groups	7.400	27	0.274		
	Total	7.467	29			

IV. DISCUSSION:

Our study's findings contribute valuable insights into the intricate relationship between diabetes and periodontal health.Higher Plaque and Gingival Index Scores in Non-Diabetic Patients,our research indicates that non-diabetic chronic periodontitis patients exhibit higher plaque and gingival index scores compared to their diabetic counterparts. This observation aligns with previous literature, such as the work of Löe (1993) and Lalla & Papapanou (2011), which suggests a bidirectional relationship between diabetes and periodontitis, where each condition may worsen the other.

Impact of Diabetes on Periodontal Indices- Interestingly, our study suggests that within diabetic groups, diabetes does not necessarily exacerbate periodontal indices like probing depth and bone loss. The lack of significant differences between the diabetic subgroups in your study, indicated by a P value greater than 0.05, supports this notion. This finding is in line with Polak and Shapira (2018), who discuss the complex pathogenic mechanisms that link these diseases.

Correlation Between Periodontal Disease Progression and HbA1C Levels,The absence of a correlation between the progression of periodontal disease and HbA1C levels in our study resonates with the findings of Wolff et al. (2009). This suggests that factors other than glycemic control may play a more critical role in influencing periodontal status in diabetic patients.

Importance of Oral Hygiene and Public Health Policies**,** our results emphasize the significance of maintaining oral hygiene to prevent the progression of periodontal disease. This is supported by Lertpimonchai et al. (2017) and Duangthip and Chu (2020), who advocate for improved public health policies and individual management strategies to enhance oral health outcomes.

While our study confirms the interplay between diabetes and periodontal health, it also highlights the need for further investigation to fully understand the specific pathways and the influence of glycemic control on periodontal health. Larger-scale studies are suggested to refine these observations and clarify the relationship.

In summary,our study adds a new dimension to our understanding of periodontal health in diabetic patients, suggesting that diabetes management alone may not be sufficient to predict or prevent periodontal disease progression. It underscores the need for comprehensive oral hygiene practices and public health interventions to manage periodontal health effectively. The call for larger-scale studies is crucial to develop a more pronounced understanding of the bidirectional relationship between these two conditions.

V. CONCLUSION:

In conclusion, our study reveals that patients with chronic periodontitis generally exhibit inadequate plaque control and poor gingival health when compared to diabetic groups. This is evident from their higher average plaque index and gingival index scores. Additionally, non-diabetic chronic periodontitis patients tend to have more pronounced probing pocket depth and bone loss. Surprisingly, when comparing diabetic groups (AT2D and IT2D), we found no significant differences in these parameters. This suggests that the presence of diabetes alone may not worsen periodontal deterioration in terms of pocket depth and bone loss. Moreover, the slight variations in average scores between the two diabetic groups, AT2D and IT2D, were insufficient to establish a correlation with HbA1C levels. Hence, it can be inferred that the progression of periodontal disease in diabetic patients may not strongly correlate with HbA1C levels, implying that other factors might have a more significant impact on the periodontal status of diabetic patients. However, further research with a larger sample size is necessary to reach a definitive conclusion.

REFERENCES:

[1.] Assessing national capacity for the prevention and control of non communicable diseases: report of the 2017 global survey. Geneva: World Health Organization; 2018.

[2.] Anjana RM, Unnikrishnan R, Deepa M, Pradeepa R, Tandon N, Das AK, Joshi S, Bajaj S, Jabbar PK, Das HK, Kumar A, Dhandhania VK, Bhansali A, Rao PV, Desai A, Kalra S, Gupta A, Lakshmy R, Madhu SV, Elangovan N, Chowdhury S, Venkatesan U, Subashini R, Kaur T, Dhaliwal RS, Mohan V; ICMR-INDIAB Collaborative Study Group. Metabolic non-communicable disease health report of India: the ICMR-INDIAB national cross-sectional study (ICMR-INDIAB-17). Lancet Diabetes Endocrinol. 2023 Jul;11(7):474-489. doi: 10.1016/S2213-8587(23)00119-5. Epub 2023 Jun 7. PMID: 37301218.

[3.] Löe H. Periodontal disease. The sixth complication of diabetes mellitus. Diabetes Care. 1993 Jan;16(1):329-34. PMID: 8422804.

[4.] Lalla E, Papapanou PN. Diabetes mellitus and periodontitis: a tale of two common interrelated diseases. Nat Rev Endocrinol. 2011 Jun 28;7(12):738-48. doi: 10.1038/nrendo.2011.106. PMID: 21709707.
[5.] Polak D, Shapira L. An update on the evidence for pathogenic mechanisms that may link periodontitis and diabetes. J Clin Periodontol. 2018 Feb;45(2):150-166. doi: 10.1111/jcpe.12803. Epub 2017 Dec 26. PMID: 29280184.
[6.] Lertpimonchai A, Rattanasiri S, Arj-Ong Vallibhakara S, Attia J, Thakkinstian A. The association between oral hygiene and periodontitis: a systematic review and meta-analysis. Int Dent J. 2017 Dec;67(6):332-343. doi: 10.1111/idj.12317. Epub 2017 Jun 23. PMID: 28646499; PMCID: PMC5724709.
[7.] Duangthip D, Chu CH. Challenges in Oral Hygiene and Oral Health Policy. Front Oral Health. 2020 Oct 7;1:575428. doi: 10.3389/froh.2020.575428. PMID: 35047981; PMCID: PMC8757757.
[8.] Wolff RE, Wolff LF, Michalowicz BS. A pilot study of glycosylated hemoglobin levels in periodontitis cases and healthy controls. J Periodontol. 2009 Jul;80(7):1057-61. doi: 10.1902/jop.2009.080664. PMID: 19563284.
[9.] Hansen BF, Gjermo P, Bergwitz-Larsen KR. Periodontal bone loss in 15-year-old Norwegians. J Clin Periodontol. 1984 Feb;11(2):125-31. doi: 10.1111/j.1600-051x.1984.tb00840.x. PMID: 6583211.
[10.] Hansen BF, Gjermo P, Bellini HT, Ihanamaki K, Saxén L. Prevalence of radiographic alveolar bone loss in young adults, a multinational study. Int Dent J. 1995 Feb;45(1):54-61. PMID: 7607746.