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Assessment Of Periodontal Health Status Among Diabetes Mellitus and Hypertensive Patients – A Case Control Study

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ABSTRACT

Introduction: Oral health is an important factor which contributes to patients overall health of age groups from childhood to geriatrics. In midlife of human's common oral problems include gum disease periodontal disease, tooth loss, dry mouth (xerostomia), mucosal lesions and tooth decay, which can be exacerbated by factors like reduced saliva production and multiple medications. With this background the present study was designed to assess the periodontal health status in diabetic mellitus, hypertensive patients and to compare with control group.

Materials and Methods: A total 300 patients were recruited for the study which included 100 normal subjects, 100 diabetic Mellitus (type 2) and 100 hypertenisve patients. The through intra oral examination was done using mouth mirror, CPITN – C probe,no 5 explorer, and community periodontal index, loss of atatchement and oral hygiene index was recorded and compared between the three groups.

Results: Majority of patient in our study were males and most common age group was 51-60 years. Assessment of community periodontal index showed healthy gingiva more commonly in control subjects, Majority of the diabetic patients were having periodontitis followed by hypertensive patients than the healthy subjects. In majority of diabetic patients loss of attachment was common than the hypertensive and healthy subjects. In our study generalized periodontitis was most common than the localized periodontitis.

Conclusion: Oral health status of periodontium was more compromised in diabetic patients followed by hypertensive patients. The physician and dentist together should contribute the control of gingival and periodontal disease by maintaining the oral hygiene and status of diabetes and hypertension in patients. .

Keyword: *Periodontal disease. Probing depth, Diabetes mellitus, Hypertension*.

1. INTRODUCTION

Oral health is an important factor which contributes to patients overall age group from childhood to death. In midlife of humans common oral problems include gum disease periodontal disease, tooth loss, dry mouth (xerostomia), mucosal lesions and tooth decay, which can be exacerbated by factors like reduced saliva production and multiple medications.

Periodontitis is one such major problem associated with midlife and old age group. It is a widespread chronic inflammatory condition marked by the destruction of the supporting structures of the teeth, including the periodontal ligament and alveolar bone. In periodontitis, tissue destruction leads to the breakdown of collagen fibers in the periodontal ligament, creating a periodontal pocket between the gum and the tooth. The periodontal pockets are assessed using periodontal probes like Willams probe, Nabers probe. [1]This disease is caused by a bacterial biofilm, primarily stemming from an infection. The main etiological agents (microorganisms) include Aggregatibacteractinomycetemcomitans, Porphyromonasgingivalis, and Tannerella forsythia, along with other bacteria. It can also be influenced by iatrogenic factors, systemic diseases, immune dysfunction, smoking, obesity, and other causes. [2]The aggravating factors of the disease can be the occurrence of loss of bone structure,loss of attachment, and formation of a periodontal pocket, and even periodontitis can produce changes in systemic health, including diabetes Mellitus, stroke, kidney failure, premature birth, diabetes, and coronary diseases. [2]

The bidirectional relationship between periodontal disease (PD) and diabetes mellitus is frequently discussed in the literature. This connection arises from multiple and complex mechanisms, influenced by shared etiopathogenic factors and overlapping phenomena related to their high prevalence. Diabetes mellitus is a complex disease that includes several metabolic dysfunctions caused by a long-term state of hyperglycemia. The hyperglycemic status is generally a consequence of decreased insulin secretion and action. Diabetes mellitus can have an insidious/silent onset, with a family history often being described. Diabetes mellitus is traditionally classified into autoimmune (T1DM) and non-autoimmune forms (T2DM). From a clinico-pathological standpoint, other subtypes have been identified, including monogenic diabetes (such as maturity-onset diabetes of the young and neonatal diabetes), gestational diabetes, and a potentially late-onset autoimmune variant known as latent autoimmune diabetes in adults. Multiple studies indicate that patients with poorly managed diabetes or difficulty maintaining their serum glucose levels are 2–3 times more likely to develop periodontitis, with glycemic control being a crucial risk factor. Furthermore, long-term studies have revealed a higher incidence of progressive periodontitis in individuals with diabetes. [3]

Hypertension is defined as a chronic condition characterized by high blood pressure. A long side cardiovascular complications, it is linked to alterations in collagen metabolism, increased systemic inflammation, and heightened oxidative stress. Essential or primary hypertension is a multifactorial disorder marked by systolic and diastolic blood pressure readings of 140 mmHg or higher and 90 mmHg or higher, respectively. Other contributing risk factors for hypertension include alcohol abuse, physical inactivity, excessive sodium intake, and obesity. Increased systemic inflammation can negatively impact arterial function, thereby raising the risk of hypertension. Additionally, individuals with other immunoinflammatory conditions, such as psoriasis, rheumatoid arthritis, systemic lupus erythematosus, and possibly periodontitis, may also be predisposed to developing hypertension. [4] Hypertension and periodontitis mutually trigger the release of pro-inflammatory cytokines from immune-related cells, both of which influence cardiovascular disease. With this background the present study was designed to assess the status of periodontal assessment in control subjects, Diabetes mellitus and Hypertensive patients.

2. MATERIALS AND METHODS

Experimental Design:

This cross-sectional, observational study was conducted for a period of ten months on patients visited the outpatient department of Oral Medicine and Department of Periodontology.

Sample Calculation:

The sample size was calculated from a finite population of 135 patients who were being monitored in the extension project entitled “Periodontal medicine in academic training and in the transformation of social and preventive behaviors”, considering a prevalence reported in the scientific literature of 66% of hypertensive patients with periodontitis, [5] with an accuracy of 5% and a confidence interval of 95%, idealizing a minimum sample of 89 individuals.

a) Sampling Strategy:

$$n = \frac{(Z_\alpha)^2 * (pq)}{(L)^2}$$

Zα = 1.96, type 1 error at 5% level of significance

p = Proportional of Type II Diabetes mellitus patients having periodontal destruction = 90%

Hypertensive patients

q = 100 - p = 10 =%

L = allowable error = 6 %

N = 96

A total of 300 patients were recruited out of which 100 were control, 100 Type 2 Diabetes Mellitus , 100 were hypertensive patients who were previously diagnosed and under medication.

Ethical consideration-The ethical clearance was obtained from the ethical committee from Krishna Vishwa Vidypeeth, KVV/IEC/10/2024. The patients consent was taken before enrolling them in the study.

Inclusion criteria:

1. Patients, within the age group of 30–90 years, have been diagnosed as Type 2 Diabetes Mellitus (T2DM) for at least the past 2 years based on criteria given by the WHO (random blood sugar [RBS] level ≥200 mg/dl, fasting plasma glucose ≥126 mg/dl, and 2hours postprandial glucose ≥200 mg/dl) without any other systemic diseases.

2. Patient with 8 or more teeth in oral cavity.

3. Non smoker, non alcoholic patients.

4. Diagnosed hypertensive patients without Diabetes Mellitus and under the medications.

Exclusion criteria:

Patients with infectious diseases, kidney or liver disorders, cancer, and pregnant or lactating women were excluded. Patients who have undergone periodontal therapy in the past three months and under antibiotics for the past month, Patients having 3rd molar impaction, endodontic problems were also excluded.

Periodontal assessment

Comprehensive demographic information and medical history including conditions such as diabetes, hypertension, were recorded, along with their duration. A thorough intraoral examination was performed, The examination for each patient was done using mouth mirror, CPITN-C probe, and No. 5 explorer (Shepherd's Crook) and assessments of periodontal health including the number of missing teeth, community periodontal index(CPI) , loss of attachment and oral hygiene index were measured using WHO-probe (Hu-Freidy, Chicago, IL, USA). [6] Oral examination was carried out by a single and trained examiner to prevent differences in measurements. Community Periodontal Index (CPI index) (with scoring criteria as healthy code-0, bleeding on probing code-1, presence of calculus code-2, pocket depth of 4-5mm code-3, pocket depth of 6mm code-4) and the Loss of Attachment Index 0-3mm code 0, 4-5mm code 1. 6-8mm code 2. 9-11 mm code 3. > 12 mm code 4. Oral hygiene for each patient was assessed according to Oral Hygiene Index-Simplified and categorized into Good oral hygiene, Fair, and Poor oral hygiene. Indexed teeth: 17/16, 11, 26/27 (buccal surfaces) and 47/46, 31, 36/37 (lingual surfaces) were examined during the oral examination.

Data analysis

All the relevant data were recorded and subjected to statistical analysis. Statistical analysis was done using the SPSS version 25.

3. RESULTS

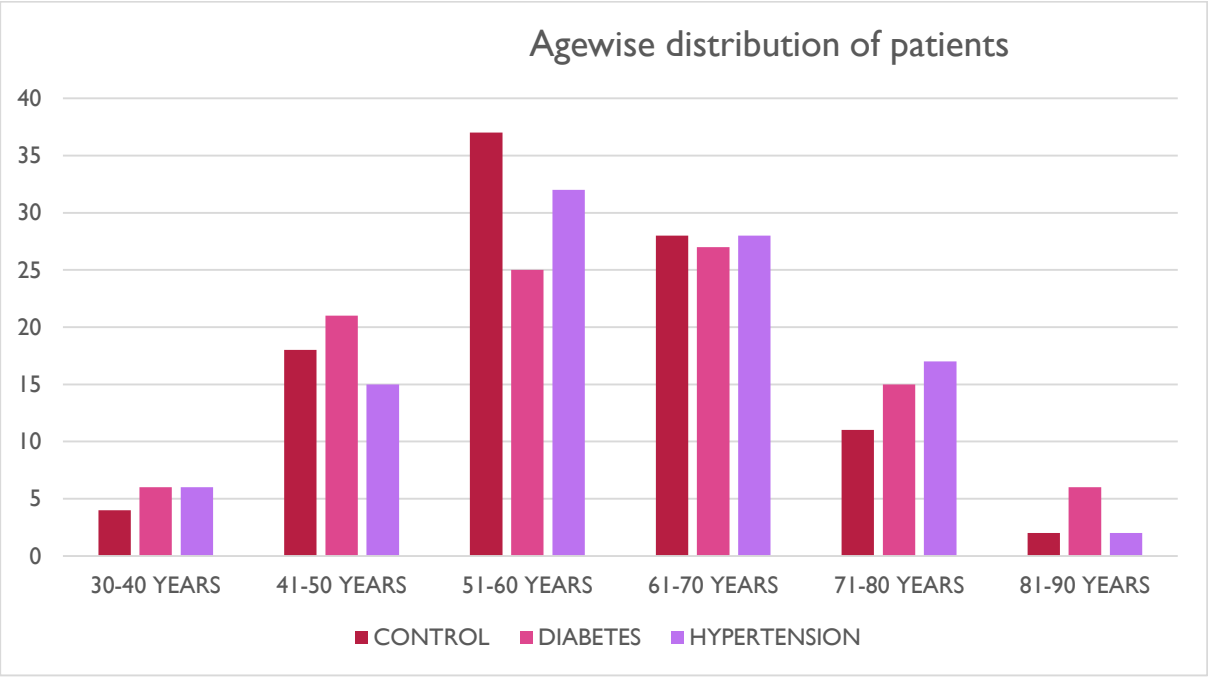
Out of total 300 patients majority were males accounting for 51. 6%(n=155) and 48.3%(n=145) were females [Table 1].

Table 1: Gender wise distribution of patients

Sex	Control Group	Diabetes Mellitus group	Hypertensive Group	Total
Male	47	57	51	155
Female	53	43	49	145
Total	100	100	100	300

Age wise distribution of patients in our study showed majority in the age group of 51-60 years accounting for 31.3% followed by 61-70 years age group accounting for 27.6%. there were less number of patients in the age group of 80-90 years [Graph 1].

Graph 1: Age wise distribution of patients



Duration of Diabetes mellitus of patients in our study showed majority were suffering from diabetes since five to nine years which accounted for 48 cases and majority of hypertensive patients were below the five years which accounted for 41 cases [Table 2].

Table 2: Distribution of duration of Diabetes mellitus and Hypertension in patients

Variable	Duration of condition	N %	
Diabetes	< 5years > 5years < 9 years > 9 years	24 48 28	-
Hypertension	< 5years > 5years < 9 years > 9 years	41 35 24	

CPI index assessment revealed that majority of the control patients were having code 0 and code 1, where as code 2 was common in hypertensive patients and code 3 and code 4 were common in diabetic patients [Table 3].

Table 3: Assessment of Community periodontal index (CPI)

Variables	Codes	Control group	iabetes meallitus patients	Hypertensive patients
Community Periodontal index	Healthy -0	39	5	32

	Bleeding on probing -1	19	9	15
	Calculus detected -2	11	6	18
	Pocket 4-5 mm -3	16	45	30
	Pocket > or equal to 6mm - 4	15	36	38

Loss of attachment assessment revealed that majority of the control patients were having code 1 and code 2, where as code 3 and code 4 were common in diabetic mellitus patients and code 3 and code 4 were common in diabetic patients and code 5 was common in hypertensive patients. Assessmnet of OHI –S index showed majority of healthy patients with good oral hygiene, Poor and fair oral hygiene was most common in diabetic patients [Table 4].

Table 4: Assessment of loss of attachment and OHI –S index

Variables	Measurements in mm	Healthy subjects	Diabetes mellitus patients	Hypertensive patients
Loss of attachment	0-3mm (code 1)	45	15	30
	4-5mm (code 2)	18	8	13
	6-8mm (code 3)	6	43	21
	9-11mm(code 4)	17	23	14
	>12 mm (code 5)	14	11	22
Oral Hygiene index (OHI –S)	Good oral hygiene	56	28	45
	Fair oral hygiene	12	32	24
	Poor oral hygiene	32	40	31

Out of total 300 patients, 70.3% were having periodontitis. In 100 control patients only 60% of patients were having periodontitis, where as 81% of diabetic patients were having periodonontitis, and 70% of hypertensive patients were having periodontitis. Majority of the patients were having generalised periodontitis accounting for 68.2% followed by localized periodontitis accounting for 31.7% [Table 5 & Figure 1, Figure 2].

Figure 1- Intra oral photograph showing generalised gingival recession in maxillary and mandibular arch.

Figure 2- Intra oral photograph showing lingual aspect of mandibular anterior with gingival recession.

Table 5: Site wise distribution of patient

Site	CONTROL	DIABETES MELLITUS	HYPERTENSION	total
Localised periodontitis	21	25	21	67
Generalised periodontitis	39	56	49	144
Total no. Of patients	60	81	70	211

4. DISCUSSION

Periodontitis significantly increases the severity of diabetes mellitus and cardiovascular diseases. Arterial hypertension and periodontitis often coexist, especially in the elderly, men, cigarette smokers, overweight/obese people, diabetics, low socioeconomic status, and poor education.

In our study majority of patients were males accounting for 51.6%. In a study conducted by A. Tabassum et al in Saudi Arabia showed male predominance of about 52.6% [7] The results of our study were also in accordance with the study conducted by Ying Liu et al, [8] In another study conducted by Rahim A et al to assess the association and comparison of periodontal and oral hygiene status with serum HbA1c levels they found majority of the patients were males accounting for 59.7% (n=87) which was in accordance with the present study [6] The results of our study were also in accordance with the study conducted Janakiram C., [9] and Bharateesh J where they found higher proporation of males. [10] In a comparative study conducted by Das to to assess the Oral Health Status among Type 2 Diabetic versus Nondiabetic Adult Population they found majority of both the patients were males. [11]

Prevalence of periodontitis increased with age up to the point that 70.1% of adults ≥ 65 years old were affected by periodontal disease. [12] Men exhibit worse periodontal status than women (56.4% vs 38.4%), as well as those with limited education (66.9%) and income (65.4%). These factors, together with cigarette smoking are increased risk factors for periodontal progression. [13]

In our study majority of the patients were in the age group of 51- 60years followed by 61-70 years, where as a study conducted by Nazir et al to find the periodontal disease prevalence and its association with systemic disease they identified higher prevalence rate of periodontitis in individuals aged between 60-69 years compared with individuals 40-50 years. [14]

In a study conducted by Shaju J P to assess the prevalence of periodontitis in the Indian population included Maharashtra, Orissa, Delhi, Rajasthan, Uttar Pradesh ,Puducherry, Arunachal Pradesh,They found that the prevalence of loss of attachment was significantly higher in the 65-74 years group as compared to the 35-44 years group. The highest prevalence in 65-74 years group was recorded in Maharashtra (96%), followed by Orissa (90%), Delhi (85.5%), Rajasthan (75%), Uttar Pradesh (68%) and Puducherry (55%). Arunachal Pradesh recorded the lowest prevalence, viz., 20%. [15] In a study conducted by Janakiram C they found patients aged 65 years and above had higher prevalence of periodontitis. [9] In a study conducted by Hung Q prevalence of periodontal disease were more in middle-aged and elderly patients , which was similar to our study.

[16]

Duration of diabetes mellitus patients were in the group of > 5 years and <9 years duration followed by <5years of hypertensive patients.

In the present study assessment of CPI showed code 0 and code 1 more common in control group than the diabetics and hypertensive patients. The results of our study were in accordance with the study conducted by Rahim A et al to assess the CPI between healthy patients, controlled T2DM and uncontrolled T2DM patients. [6] The results of our study were also in accordance with the previous studies. [17, 18, 19] Majority of diabetic mellitus patients were having a Code 4 (pocket depth of 4-5mm) followed by code 5 (pocket depth > 6mm) and majority of hypertensive patients were having code 5 (a pocket depth of >6mm) followed by code 4 (pocket depth of 4-5mm). The results of our study were in accordance with the previous study conducted by Rahim A et al, [6] and other studies. [17, 18] The study conducted by Das also revealed significant differences in gingival bleeding, periodontal pocket and loss of attachment and OHI S between diabetic and nondiabetic patients. [11]

In our study loss of attachment revealed that code 1 was prevalent among healthy and hypertensive patients. Majority of diabetic patients had code 2,code 3,code 4and code 5 was most common in hypertensive patients. Regarding oral hygiene index majority of healthy patients had good oral hygiene where as poor oral hygiene is more common in diabetic patients followed by control subjects and hypertensive patients. In a study conducted by Rahim A et al uncontrolled diabetic patients had poor oral hygiene than the healthy and controlled diabetic subjects. [6]

Majority of the previous studies have demonstrated a significant association between periodontitis and diabetes. Diabetic patients had more prevalent and severe periodontal disease when compared with a healthy population. [19,20] A study conducted by Lalla et al, [21] showed higher prevalence of periodontitis among diabetic patients compared to non-diabetics Also, CAL was higher in diabetic patients when the 15 to 55-year age cohort was considered. Lim et al, [22] estimated that the glycemic control was the most important risk factor related to severity and extent of periodontitis.

In a study conducted by Singh M to determine the prevalence of periodontal disease in type 2 diabetes mellitus patients of North India. More than 90% (95.1%) of the total diabetic participants had some degree of periodontal destruction. [23]A study conducted by Kumar et al, [24]in Bareilly population they reported the prevalence of periodontitis was 91.7% among diabetic participants. Similar results were reported in the trial of Mansour and Abd-Al-Sada, [25] and Zhang et al. [26] who reported prevalence of 95.9% and 96.7% of periodontitis in type 2 diabetic populations, respectively. In the present study the CPI index and loss of attachment were more in hypertensive patients than the control group. The results of our study were in accordance with the study conducted by Li, Y., Yuan to assess the association of periodontal disease and oral health with hypertension in a study conducted from National Health and Nutrition Examination Survey (NHANES) 2009–2018 and they found a positive association between oral health and periodontal disease with hypertension. [27]

In A cross-sectional Fourth National Oral Health Survey conducted by Zhan Y et al in China between 2015–2016 severe periodontitis (stages III and IV) was present in 41.4% of individuals with hypertension and 28.0% of individuals with normotension, respectively ($p<0.001$). The prevalence of severe periodontitis was higher in individuals with hypertension than that in individuals with normotension patients. [28]

The pathophysiological mechanism that could explain the association between periodontitis and hypertension are endothelial dysfunction, oxidative stress, inflammatory and biological pathways, local bacteria and immune response.

Hypertension and periodontitis mutually release pro-inflammatory cytokines from immune-related cells, which both impact cardiovascular disease. Exacerbated systemic inflammation can result in endothelial dysfunction following the onset of hypertension as well as atherosclerosis. The endothelial dysfunction harmfully reduces periodontal vascularization and subsequently impairs periodontal health. In our study 70% of patients with hypertension were having periodontitis. in a study conducted by Zhan Y, *et* al prevalence of hypertension increased with severity of periodontitis. [28]

In our study majority of patients were having chronic generalised periodontitis 67% followed by localised periodontitis 33%.whereas in a study conducted by Prathypaty SK et aal they found higher prevalence of chronic localised periodontitis of about 46.8% than the chronic generalised periodontitis of about 43.5%. [29]

5. CONCLUSION

Periodontitis is a chronic inflammatory disorder associated with systemic disorders like diabetes mellitus, hypertension , gastro intestinal disorders, respiratory disorders , since oral cavity is the mirror of over all health diagnosis of gingival and periodontal diseases with their management helps in controlling severity of associated systemic disorders. Dentists should be aware of the diabetic status and hypertensive status of their patients and at the same time the physicians/diabetologist should also be aware of the oral complication of these disorders.

Study limitations

The sample size was based on only the previous history and present medications of the patients. The blood sugar levels of

the patients would have been considered.

Future prospect

Studies with a larger sample size, and assessment of blood sugar levels could be included in the study

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