# The Prevalence of Diabetes and Hypertension among Patients with Chronic Periodontitis - A Retrospective Study

Research Article

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## Abstract

Periodontitis is a chronic inflammatory disease characterised by destruction of the supporting structures of the teeth. It is a common cause of poor oral health. Diabetes and hypertension is one of the major risk factors for periodontal diseases. The aim of the study was to assess the prevalence of diabetes and hypertension among chronic periodontitis patients. A retrospective data of all the patients reporting to Saveetha Dental College And Hospital, Chennai for periodontal therapy were collected from the patient records. Data extraction was done and segregated based on age, gender and types of periodontitis. It was found that 58.33% of males and 41.67% of females were affected with diabetes and hypertension. Patients with 45-55 years were affected by 50%, 56-65 by 25% and above 65 by 25%. Generalised chronic periodontitis was present in diabetes and hypertensive patients (83.33%). Maximum probing depth of 41.67% was present and clinical attachment loss of 58.33% . 41.67% of patients had blood sugar above 200 mg/dl. 50% of patients had blood pressure level 151-170 mm Hg systolic and 80-90 mm Hg diastolic. Association between probing depth and the blood sugar levels showed significance, the P value 0.025(p<0.05). From the above study we found that the age group that was more predominant was 45-55 years. Diabetes and hypertension was more prevalent in males. The association between probing depth and diabetes was significant.

**Keywords:** Chronic Periodontitis; Clinical Attachment Loss; Diabetes; Hypertension; Prevalence; Probing Depth.

## Introduction

Periodontal diseases are a group of chronic inflammatory diseases involving the soft tissues and bone surrounding the teeth and the jaw or known as periodontium [17]. Periodontitis is characterised by inflammatory changes seen in the tooth supporting tissue which is caused by bacterial infection. Periodontal disease includes both gingivitis and periodontitis. Gingivitis is a very common condition which is reversible. Gingivitis in response to bacterial plaque accumulation is considered the key risk factor for the onset of periodontitis. Plaque not just contains bacteria it also contains viruses which can cause disease progression [28]. It will cause further destruction of periodontal tissues,ligament and alveolar bone if left without appropriate treatment [40]. It is manifested as redness, gingival enlargement, gingival recession and bleeding. This process causes release of various toxic products from the pathogenic bacteria plaque in addition to the inflammation of the gingiva elicited by the host response [16, 23, 1, 9]. The tissue destruction in periodontal disease results in breakdown of collagen fibers of the periodontal ligament, resulting in the formation of a periodontal pocket between gingiva and tooth. Periodontitis is a slowly progressing disease but the tissue destruction that occurs is highly irreversible [11].

Tumor necrosis factor-alpha is an important proinflammatory mediator that causes destruction of periodontal tissues [41]. Similarly recent studies have reported association between Interleukin-21 levels with periodontitis [21]. Inorder to prevent the further progression of the disease condition various periodontal therapies can be performed. Periodontal therapy primarily aims at the elimination of the disease and maintenance of a functional, healthy dentition and supporting tissue. Periodontal therapy can be non surgical,surgical and supportive periodontal therapy. A team has worked on various regenerative therapy that has been

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indicated for periodontally compromised patients [2, 25, 33] and other treatments such as coronally displaced flap, lip repositioning ect [34, 39]. Management of generalised chronic periodontitis patients where the esthetics and function had to be restored dental implants and implant-supported prosthesis can be a predictable treatment modality in periodontal diseases [33]. While performing surgical therapy trauma to the inferior alveolar nerve is one of the complications during surgical procedures in the posterior mandible [12]. Various antimicrobial and chemotherapeutic agents such as chlorhexidine mouth washes, triclosan are employed for the management of periodontitis [30]. Herbal medicines and preparations can also be used for the management of periodontal diseases [32].

Diabetes mellitus is a chronic metabolic disease which is characterised by the presence of hyperglycemia [3]. Hyperglycemia triggers a wide variety of long term complications in diabetes such as large vessel disease, cardiomyopathy and kidney and eye impairments [5, 6]. Both type 1 and type 2 diabetes mellitus are associated with elevated levels of systemic markers of inflammation [8]. The elevated inflammatory state in diabetes contributes to both microvascular and macrovascular complications and thus it is clear that hyperglycemia can result in activation of pathways that increase inflammation, oxidative stress and apoptosis [4]. Elevated levels of IL-6 and TNF alpha have been demonstrated in diabetes. Serum level of IL-6 and c reactive proteins have been shown to predict future occurrence of type 2 diabetes mellitus [38]. Increase in the level of CPR is also associated with insulin resistance, type 2 diabetes mellitus and cardiovascular diseases [22]. From various studies it was found that there will be defects in polymorphonuclear leukocytes activity in patients with diabetes including impared chemotaxis, phagocytosis and microbial function.

Hypertension is defined when a patient has an elevated systolic blood pressure value greater than 140 mm hg or diastolic blood pressure greater than 90 mm hg [6]. Over the past few decades vascular inflammation has a role in mechanisms that participates in progression of hypertension [10, 15, 37]. Endothelin-1 is a potent vasoconstrictor peptide with a multi functional activity in various systemic diseases [13, 14]. Certain inflammatory pathogens involved in pathogenesis of hypertension are vascular cell adhesion molecule -1 and intercellular adhesion molecule-1 are expressed by endothelial cells. There will be an upregulation in their expression in response to inflammatory insults. VCAM-1 and ICAM -1 are recognised as important cardiovascular risk markers [7, 27]. This will mediate leukocytes binding to the endothelial lining. Increased leukocytes infiltration and production of cytokines exaggerate oxidative stress and inflammation eventually causing disturbance to the normal endothelial function in regulating the blood pressure. Endothelial cells play a crucial part in BP homeostasis through the synthesis of vasodilators such as endothelium-1, thromboxane and nitric oxide, PGI2 and angiotensin II.

The aim of the study was to assess the prevalence of diabetes and hypertension among chronic periodontitis patients.

## Materials and Methods

This was a retrospective study. We reviewed patient records and analysed the data of the patients visiting Saveetha Dental College And Hospital, Chennai. The data collected were segregated based on the type of systemic conditions that the patients had where a total of 280 patients with periodontitis had 1) diabetes 2) hypertension 3) diabetes and hypertension. It was found that out of the 280 patients 85 patients were having periodontitis with systemic condition. Out of the 84 patients 52 patients were diabetic, 20 patients were hypertensive and 12 patients were diabetic and hypertesive.

The 12 patients with diabetes and hypertension were evaluated for periodontal status. It was found that 10 patients had generalised chronic periodontitis and 2 patients had localised chronic periodontitis.The blood sugar value of each patient were collected and was grouped into 3 ; (120-150), (151-200) (above 200). The blood pressure levels of patients were collected and was grouped into 3 groups; (systolic 130-150 mm Hg and diastolic 80-90 mm Hg), (systolic 150-170 mm Hg and diastolic 80-90 mm Hg) (systolic above 170 mm Hg and diastolic 80-90mm Hg).To ensure the relationship between different clinical variables and diabetes and hypertension the following parameters were included.

1) Probing depth
2) Clinical attachment loss

After the datas were extracted from DIAS the full mouth score of the patients were calculated which was correlated with the blood sugar value. Statistical analysis was done in SPSS software. Chi square test was performed to assess the statistical significance (p < 0.05).

Ethical consideration - the original study protocol was reviewed and approved by the research ethical committee of saveetha dental college and hospital, chennai.

## Results and Discussion

In the study it was found that male gender with periodontitis was most commonly affected with diabetes and hypertension by 58.33% (figure 1). The most common age group that was affected was 45-55 years by 50% (figure 2). Periodontitis patients with diabetes and hypertension were mostly affected with generalised chronic periodontitis by 83.33% (figure 3). Probing depth mouth score of 4mm was seen mostly in patients with diabetes and periodontitis (41.67%) (figure 4). Clinical attachment loss mouth score of 2 mm was seen mostly in patients with diabetes and periodontitis (58.33%) (figure 5). Patients with periodontitis had blood sugar level above 200mg/dl by 41.67% (figure 6). Patients with periodontitis had blood pressure level of 151-170 mm Hg systolic and 80-90 mm Hg diastolic by 50% (figure 7). From the chi square test performed to determine the correlation between probing depth of the periodontitis patients and the blood sugar levels, the P value obtained was 0.025(p<0.05) which shows a positive significance (figure 8). Chi square test performed to determine the correlation between clinical attachment loss of the periodontitis patients and the blood sugar levels, the P value obtained was 0.068 (p>0.05) which shows a negative significance (figure 10). The chi square test performed to determine the correlation between probing depth of the periodontitis patients and the blood pressure levels, the P value obtained was 0.532(p>0.05) which shows a negative significance (figure 9). Chi square test per-

**Figure 1. Bar graph depicting the distribution of gender of the study population. X axis represents gender and Y axis represents percentage of patients affected. Blue bar represents male (58.33%) and the green bar represents females(41.67%). Figure 1; we can infer that diabetes and hypertension were more predominant in males by 58.33%.**
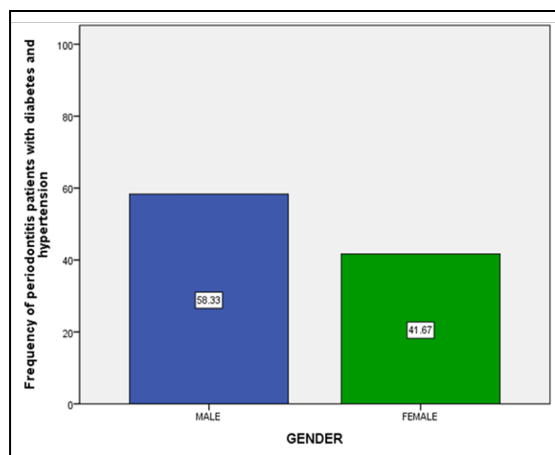


**Figure 2. Bar graph depicting the distribution of age groups of the study population. X axis represents age groups and Y axis represents percentage of patients affected. Blue bar represent 45-55years (50%), green bar represent 56-65 years (25%) and brown bar represent above 65 years (25%) .Figure 2; we can infer that diabetes and hypertension was predominant at the age 45-55 years by 50%.**
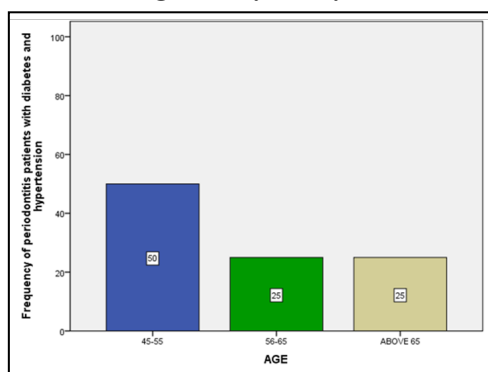


**Figure 3. Bar graph depicts distribution of periodontal status of study group. X axis represents periodontitis and Y axis shows percentage of patients affected. Blue bar represents generalised chronic periodontitis and green bar represents localised chronic periodontitis. 83.33% had generalised chronic periodontitis and 16.67% had localised chronic periodontitis. Figure 3; we can infer that 83.33% of patients had generalised chronic periodontitis with diabetes and hypertension.**
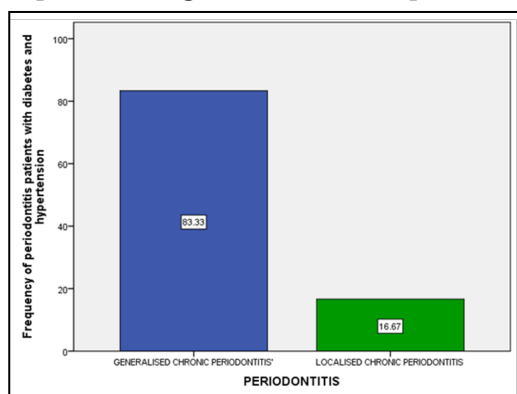


formed to determine the correlation between clinical attachment loss of the periodontitis patients and the blood pressure levels, the P value obtained was 0.246 (p>0.05) which shows a negative significance (figure 11). Chi square test performed to determine the correlation between periodontitis types and systemic conditions, the P value obtained was 0.839 (p>0.05) which shows a negative significance (figure 12).

In the study it was found that male gender with periodontitis was most commonly affected with diabetes and hypertension by 58.33% .In a previous study it was reported that periodontitis was statistically more prevalent among men P=0.001 and among participants with type II diabetes P=0.009 (Pathak et al., 2013). The chi square test performed to determine the correlation between probing depth of the periodontitis patients and the blood pressure levels, the P value obtained was 0.532(p>0.05) which shows a negative significance (figure 9). Chi square test performed to determine the correlation between clinical attachment loss of the periodontitis patients and the blood pressure levels, the P value obtained was 0.246(p>0.05) which shows a negative significance

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**Figure 4. Bar graph depicting the distribution of probing depth mouth score among the study population. X axis represents probing depth score and Y axis represents percentage of patients affected. Blue bar denotes probing depth scores of 1mm (16.67%), green bar denotes probing depth of 2mm (33.33%), brown bar denotes probing depth of 3mm (8.333%) and violet bar denotes probing depth of 4mm ( 41.67%). Figure 4; we can infer that 41.67% had a maximum probing depth score of 4mm.**
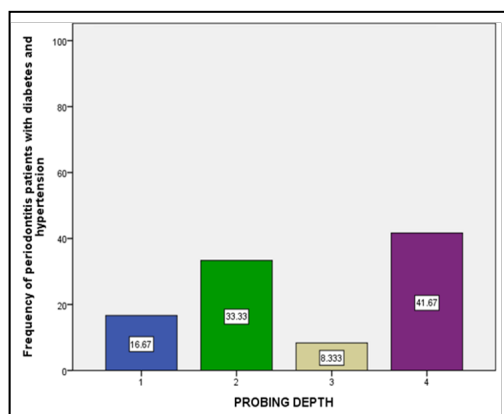


**Figure 5. Bar graph depicting the distribution of clinical attachment loss mouth score among the study population. X axis represents Clinical Attachment Loss (CAL) and Y axis represents percentage of patients affected. Blue bar denotes CAL of 1mm (8.333%) , green bar denotes CAL of 2mm (58.33%), brown bar denotes CAL of 3mm (8.333%), violet bar denotes CAL of 4mm (16.67%), yellow bar denotes CAL of 5mm (8.333%). Figure 5; we can infer that the maximum clinical attachment score of 2mm was present in diabetic and hypertensive patients by 58.33%.**
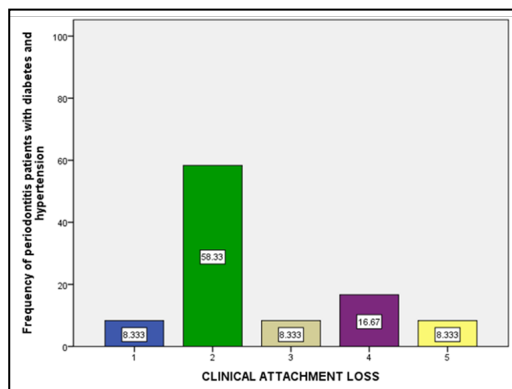


**Figure 6. Bar graph depicting the distribution of blood sugar level among periodontitis patients. X axis represents blood sugar values and Y axis represents percentage of patients affected. Blue bar represents 120-150 mg/dl (33.33%), green bar represents 150-200 mg/ dl (25%) and brown bar represents above 200 (41.67%). Figure 6; we can infer that generalised chronic periodontitis patients had maximum blood sugar level above 200 mg/dl (41.67%).**
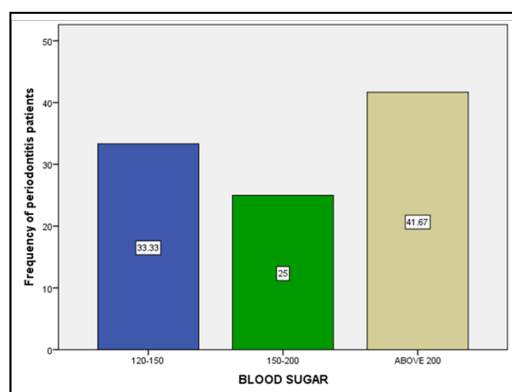


(figure 12). In a study conducted by Xin Fang Leong et al it has been reported that there is an association between hypertension and periodontitis but there is no strong proof to indicate the relationship between the two [17] but another study that was conducted by Preetha Paddmanabhan et al it was found that there is no significant correlation between periodontitis and hypertension [24]. In a study conducted by Rodrigo Martin-Cabezas it was re-ported that periodontal diseases are associated with hypertension [20]. In another study conducted it was reported that the clinical attachment loss was significantly higher in chronic periodontitis patients with hypertension compared to non-hypertensive with chronic periodontitis (P=0.012) [43]. In a previous study conducted it was reported that generalized chronic periodontitis seems to be a risk indicator for hypertensive patients [42]. Regarding the

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**Figure 7. Bar graph depicting the distribution of blood pressure level among periodontitis patients. X axis represents blood pressure values and Y axis represents percentage of patients affected. Blue bar denotes blood pressure values systolic 130-150 mm Hg and diastolic 80-90 mmHg (25%) ,green bar represent blood pressure values of systolic 151-170 mm Hg and diastolic 80-90 mmHg (50%) and brown bar represent blood pressure values of systolic above 170 mm Hg and diastolic 80-90mm Hg (25%). Figure 7 ;we can infer that generalised chronic periodontitis patients had blood pressure levels of systolic 151-170 mm Hg and diastolic 80-90mm Hg(50%).**
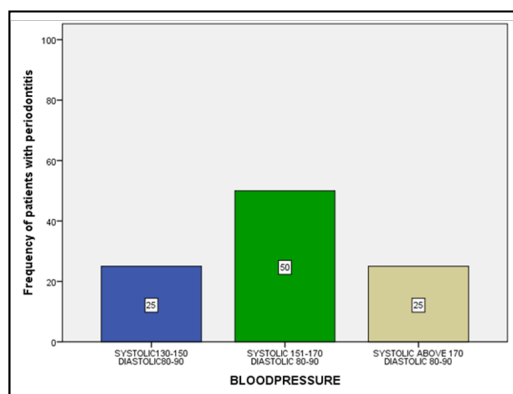


**Figure 8. Bar graph depicts the association between blood sugar level of the periodontitis patients with probing depth mouth score. X axis represents probing depth mouth score and Y axis represents the number of patients affected. Blood sugar of 120-150 mg/dl(blue bar), 151-200 mg/dl ( green bar) and above 200 mg/dl (brown bar). 33.33% of patients with blood sugar above 200 mg/dl had 4mm probing depth. 25% of patients with blood sugar 120-150mg/dl had 2mm probing depth. 16.67% of patients' blood sugar 150-200mg/dl had 1mm probing depth. 8.33% of patients with blood sugar 150-200mg/dl, above 200 mg/dl and 120-150mg/dl had probing depth 2mm,3mm and 4mm. The association between probing depth and blood sugar level had P value 0.025 (p value <0.05),was statistically significant ( Chi square test). Figure 8; we can infer that 4mm probing depth was maximum in diabteic patients with blood sugar level above 200 mg/dl (33.33%).**
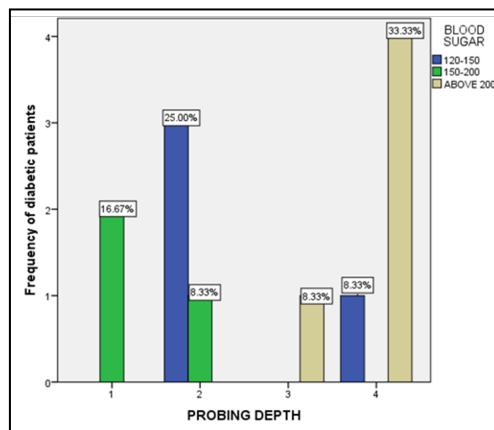


**Figure 9. Bar graph depicts the association between blood pressure level and probing depth mouth score. X axis represents probing depth mouth score and Y axis represents the number of patients affected. Blood pressure of systolic 130-150 mm Hg and diastolic 80-90 mm Hg (blue bar) ,systolic 151-170 mm Hg and diastolic 80-90 mm Hg (green bar) systolic above 170 mm Hg and diastolic 80-90 mm Hg (brown bar). 16.67% of patients with blood pressure values systolic 130-150 mm Hg and diastolic 80-90 mm Hg had probing depth 4mm,systolic 151-170 mm Hg and diastolic 80-90 mm Hg had probing depth 1mm and 4mm, systolic 170 mm Hg and diastolic 80-90 mm Hg had probing depth 2mm. 8.33% patients with blood pressure values systolic 130-150 mm Hg and diastolic 80-90 mm Hg had probing depth 2mm, systolic 151-170 mm Hg and diastolic 80-90 mm Hg had probing depth 2mm and 3mm, systolic 170 mm Hg and diastolic 80-90 mm Hg had probing depth 4mm. The association between probing depth and blood pressure level had P value 0.531 (p value >0.05),was statistically not significant ( Chi square test). Figure 9; we can infer there is no association between periodontitis and hypertension since the P value was 0.531,statistically not significant.**
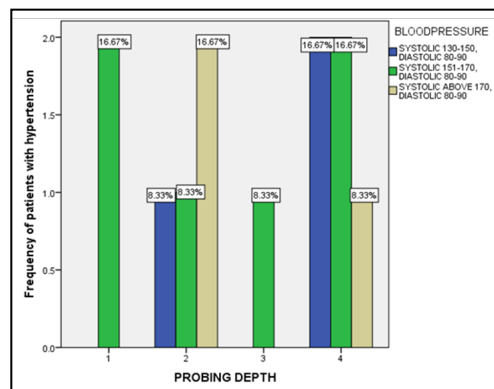


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Figure 10. Bar graph depicts the association between blood sugar level and clinical attachment loss mouth score. X axis represents clinical attachment loss mouth score and Y axis represents the number of patients affected. Blood sugar values of 120-150 mg/dl (blue bar), 151-200 mg/dl (green bar), above 200 mg/dl (brown bar). 41.67% of patients with blood sugar above 200 mg/dl had 2mm clinical attachment loss score. 16.67% of patients with blood sugar 120-150 mg/dl had4mm probing depth. 8.33% of patients with blood sugar 120-150mg/dl had clinical attachment loss of 2mm and 5mm,blood sugar 150-200 mg/dl had clinical attachment loss 1mm,2mm and 3mm. The association between clinical attachment loss and blood sugar level had P value 0.068 (p value >0.05),was statistically not significant ( Chi square test). Figure 10; we can infer there is no association between clinical attachment loss and diabetes since the P value was 0.068,statistically not significant.
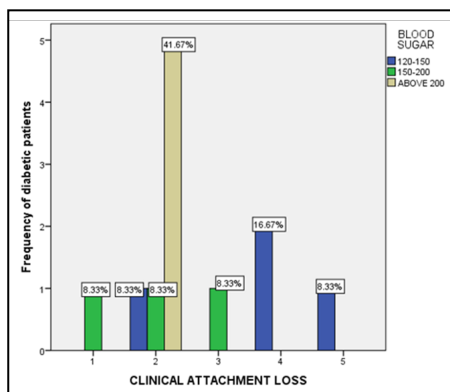


Figure 11. Bar graph depicts the association between blood pressure level and clinical attachment loss mouth score. X axis represents clinical attachment loss mouth score and Y axis represents the number of patients affected. Blood pressure of systolic 130-150 mm Hg and diastolic 80-90 mm Hg (blue bar) ,systolic 151-170 mm Hg and diastolic 80-90 mm Hg (green bar) systolic above 170 mm Hg and diastolic 80-90 mm Hg (brown bar). 41.67% of patients with blood pressure level systolic 151-170 mm Hg and diastolic 80-90 mm Hg had 2mm clinical attachment loss. 8.33% of patients with blood pressure systolic 130-150 mm Hg and diastolic 80-90 mm Hg had 2mm,4mm and 5mm clinical attachment loss, blood pressure systolic 151-170 mm Hg and diastolic 80-90 mm Hg had 3mm clinical attachment loss, blood pressure above 170 systolic and 80-90 diastolic had 1mm,2mm,4mm clinical attachment loss. The association between clinical attachment loss and blood pressure level had P value 0.246 (p value >0.05), was statistically not significant ( Chi square test). Figure 11; we can infer there is no association between periodontitis and hypertension since the P value was 0.246, statistically not significant.
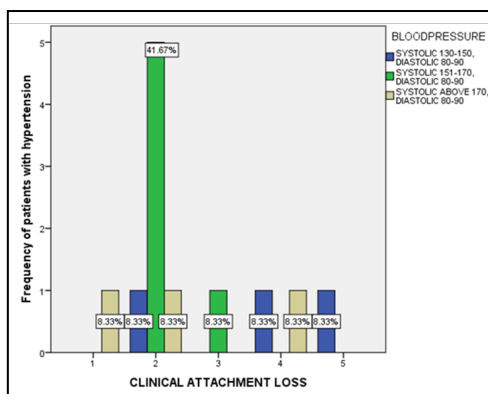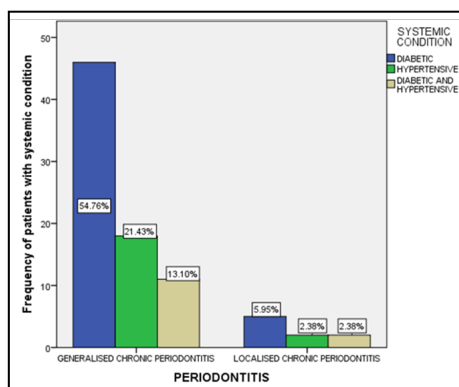


Figure 12. Bar graph depicts the association between types of periodontitis and systemic condition. X axis represents types of periodontitis and Y axis represents the number of patients affected. Blue bar (diabetic patients) green bar (hypertensive patients) and brown bar (diabetic and hypertensive patients). 54.76% of diabetic patients,21.43% of hypertensive patients and 13.1% of diabetic and hypertensive patients have generalised chronic periodontitis. 5.95% of diabetic patients, 2.38% of hypertensive patients and 2.38% of diabetic and hypertensive patients had localised chronic periodontitis. The association between types of periodontitis and systemic condition gives P value 0.839 (p value >0.05),statistically not significant ( Chi square test). Figure 12; we can infer that the majority of generalised chronic periodontitis patients had diabetes (54.76%).



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association, several studies have explained the association including endothelial dysfunction, oxidative stress and worsening of systemic inflammation in response to bacteremia or inflammatory mediator dissemination from periodontal lesion [19].

From the chi square test performed to determine the correlation between probing depth of the periodontitis patients and the blood sugar levels, the P value obtained was 0.025(p<0.05) which shows a positive significance (figure 8).Chi square test performed to determine the correlation between clinical attachment loss of the periodontitis patients and the blood sugar levels, the P value obtained was 0.068(p>0.05) which shows a negative significance (figure 11). In a study conducted by Fernando Llambes et al it was reported that periodontitis is a highly prevalent infectious disease that is related to some systemic conditions including diabetes mellitu [18]. A study conducted by Gulinuer Awuti to assess the correlation between diabetes mellitus and periodontitis it was reported that 74% with periodontitis had diabetes mellitus [3]. In another study conducted to determine the prevalence of periodontitis in diabetic patients it was found that 86% of diabetic patients had periodontal diseases [29].

Specific conditions such as inflammation, bacteremia, immune response and metabolic syndrome are associated with classical risk factors that contribute to development of the periodontal disease. Periodontal disease can also present endothelial and vascular dysfunction which may lead to increased blood pressure. It is interesting to observe that both periodontal disease and hypertension share common cardiovascular risk factors, which enhance the association between both disorders.Diabetes increases inflammation in the periodontal tissues. In the gingival crevicular fluids, levels of PGE2 and IL-1β are higher in type 1 diabetic patients with periodontitis compared with those in non-diabetic individuals with the same level of periodontal disease. Periodontitis is not just associated with diabetes mellitus and hypertension , it is also associated with other systemic diseases [32].

The limitation of this study is the limited sample size. Future scope of the study is that it can be used in diagnosis and treatment planning as well as used for future research with a larger population.

## Conclusion

From the above study we found that the age group that was more predominant was 45-55 years. Diabetes and hypertension was more prevalent in males. The association between probing depth and diabetes was significant statistically.

## Authors Contribution

Gayathri R Menon, Dr Shankari Malaiappan were the main contributors to the concept, design, literature analysis, workshop discussions, and drafting and revising manuscript. Dr Shankari Malaiappan and Dr Kiran Kumar contributed to drafting and revising manuscripts. All authors gave final approval of the version to be published.

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