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PREVALENCE AND SEVERITY OF PERIODONTAL DISEASE AMONG DIABETIC PATIENTS IN PAKISTAN: A CROSS-SECTIONAL STUDY

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ABSTRACT
This study aims to determine the prevalence and severity of periodontal disease among diabetic patients in Pakistan. Periodontal disease, a chronic inflammatory condition affecting the supporting structures of the teeth, is significantly manifested in individuals with systemic diseases such as diabetes mellitus. This cross-sectional study was conducted at Jinnah Postgraduate Medical Centre (JPMC) from January 2022 to September 2023, involving 225 diabetic patients selected through a non-probability convenience sampling method. The results indicate a high prevalence of periodontal disease, with 78% of participants affected. The findings underscore the need for improved dental care and awareness regarding the relationship between diabetes and periodontal health.

Keywords: Periodontal disease, Diabetes Mellitus, Prevalence.

1. Introduction
Periodontal disease is a chronic inflammatory condition that affects the supporting structures of the teeth and is recognized as a significant oral health issue. This condition is particularly prevalent and severe in individuals with systemic diseases, notably diabetes mellitus. Unfortunately, the situation is exacerbated in Pakistan, where Type 2 diabetes mellitus has reached epidemic proportions [1]. Identifying correlations between these two diseases is crucial. It is well documented that poorly controlled diabetes escalates inflammation in the connective tissues of the periodontal unit, thus increasing the severity of periodontal disease manifestations [2]. Diabetes mellitus (DM), characterized by elevated blood glucose levels, results from either insulin deficiency, decreased insulin sensitivity, or a combination of both. It is a metabolic disease resulting from the deficiency of insulin reduced sensitivity to insulin, or both. Type 1 diabetes results from immunogenic destruction of pancreatic insulin-secreting β cells, leading to decreased insulin production [3]. Type 2 diabetes arises from insulin resistance and dysfunction. Diabetes currently impacts more than 10% of the

population in many countries. Approximately 462 million people globally are affected by diabetes [4]. Diabetes and periodontitis are mutually exacerbating conditions; high levels of glycemia negatively impact oral health, while periodontal disease can worsen glycemic control and lead to complications [5].

Consequences of periodontal disease in diabetic patients include immunological and vascular disorders and diabetic ketoacidosis. Chronic inflammation from periodontal disease complicates glycemic control, creating a vicious cycle that exacerbates both conditions. Research indicates that diabetic patients are two to three times more likely to develop periodontal disease than non-diabetic individuals [7]. Furthermore, diabetic patients experience a higher degree of periodontal disease progression, leading to periodontal attachment loss, bone deterioration, and tooth loss. In Pakistan, healthcare facilities face the dual burden of diabetes and periodontal diseases [8]. Factors such as limited access to dental care, particularly in rural areas, and insufficient knowledge about the relationship between oral health and systematic health contribute to the increased incidence and severity of periodontal disease among diabetic patients [9]. Socio-cultural factors, including dietary habits and oral hygiene practices, also play a significant role in determining periodontal health [10,11,12]. [10,11,12].

2. Objective

The study's primary objective is to assess the prevalence and severity of periodontal disease in diabetic patients in Pakistan.

3. Methodology of the study

This cross-sectional study was conducted at Jinnah Postgraduate Medical Centre (JPMC) from January 2022 to September 2023. Data were 225 diabetic patients selected through a non-probability convenience sampling method. Patients aged 18 years and older who had been diagnosed with diabetes mellitus for at least one year with both type 1 and type 2 diabetic patients were included in the study. Patients with a history of periodontal treatment within the last six months, those on long-term antibiotics, or those with other systemic conditions known to affect periodontal health (such as HIV/AIDS or hematologic disorders) were excluded from the study.

4. Data Collection

A structured questionnaire and comprehensive clinical examination were used for data collection. The questionnaire included demographic data, type and duration of diabetes, glycemic control, and oral hygiene practices. Smoking status and other risk factors for periodontal disease were also recorded. Clinical examinations assessed periodontal health, measuring probing depth (PD) at six sites per tooth using calibrated metal periodontal probes.

5. Data Analysis

The collected data were analyzed using SPSS v29. Descriptive statistics summarized the demographic and clinical characteristics of the study population. The prevalence of periodontal disease was determined based on periodontal pockets, attachment loss, and gingival inflammation severity.

6. Result

The study sample comprised 225 individuals, with a higher proportion of males (57.8%) than females (42.2%). Most participants had Type 2 Diabetes (65%), and 60% had poorly controlled glycemic levels (HbA1c > 7%). Regarding diabetes duration, 37.8% had the condition for 5-10 years, 32% for over 10 years, and 30.2% for less than 5 years.

Table 1: Demographic and Clinical Characteristics of Study Population (n=225)

Characteristics		Frequency	Percentage
Gender	**Male**	130	57.8%
	Female	95	42.2%
Type of Diabetes	**Type 1 Diabetes**	79	35%
	Type 2 Diabetes	146	65%
Glycemic Control (HbA1c)	**Well-Controlled (≤7%)**	90	40%
	Poorly Controlled (>7%)	135	60%
Duration of Diabetes	**< 5 years**	68	30.2%
	5-10 years	85	37.8%
	> 10 years	72	32%

A total of 78% of participants exhibited some form of periodontal disease. Among these, moderate periodontal disease was most prevalent (38%), while mild and severe periodontal diseases were observed in 22 and 18%, respectively.

Table 2: Prevalence and Severity of Periodontal Disease (n=225)

Severity of Periodontal Disease	Frequency	Percentage
No Periodontal Disease	49	22%
Mild Periodontal Disease	50	22%
Moderate Periodontal Disease	85	38%
Severe Periodontal Disease	41	18%
Total	176	78%

In the study, gingival inflammation was most commonly moderate, with 49% of participants showing a GI score of 2, while 29% had severe inflammation (GI score of 3), and 22% had mild inflammation (GI score of 1). For plaque levels, 49% had a moderate plaque index (PI score of 2), 33% had a high plaque index (PI score > 2), and 18% had a low plaque index (PI score < 2).

Table 3: Gingival and Plaque Indices (n=225)

Index Type		Severity	Frequency	Percentage
Gingival Index	Mild Inflammation	(GI Score = 1)	50	22%
	Moderate Inflammation	(GI Score = 1)	110	49%
	Severe Inflammation	(GI Score = 1)	65	29%
Plaque Index	Low Plaque	(PI Score < 2)	40	18%
	Moderate Plaque	(PI Score = 2)	110	49%
	High Plaque	(PI Score > 2)	75	33%

73% of participants exhibited some degree of bleeding on probing (BOP). Moderate BOP was the most common, affecting 36% of the participants, followed by severe BOP in 24% and mild BOP in 13%. The remaining 27% showed no BOP.

Table 4: Bleeding on Probing (BOP)

BOP Severity	Frequency	Percentage
No BOP	60	27%
Mild BOP	30	13%
Moderate BOP	80	36%
Severe BOP	55	24%

The study found that among participants with well-controlled glycemic levels, 20% had moderate periodontal disease, while among those with poorly controlled glycemic levels, 18% had moderate periodontal disease.

Table 5: Association Between Glycemic Control and Severity of Periodontal Disease (n=225)

Glycemic Control	Severity of Periodontal Disease	Frequency (n=225)	Percentage (%)
Well-Controlled	Mild	30	13%
	Moderate	45	20%
	Severe	15	7%
Poorly Controlled	Mild	20	9%
	Moderate	40	18%
	Severe	26	12%

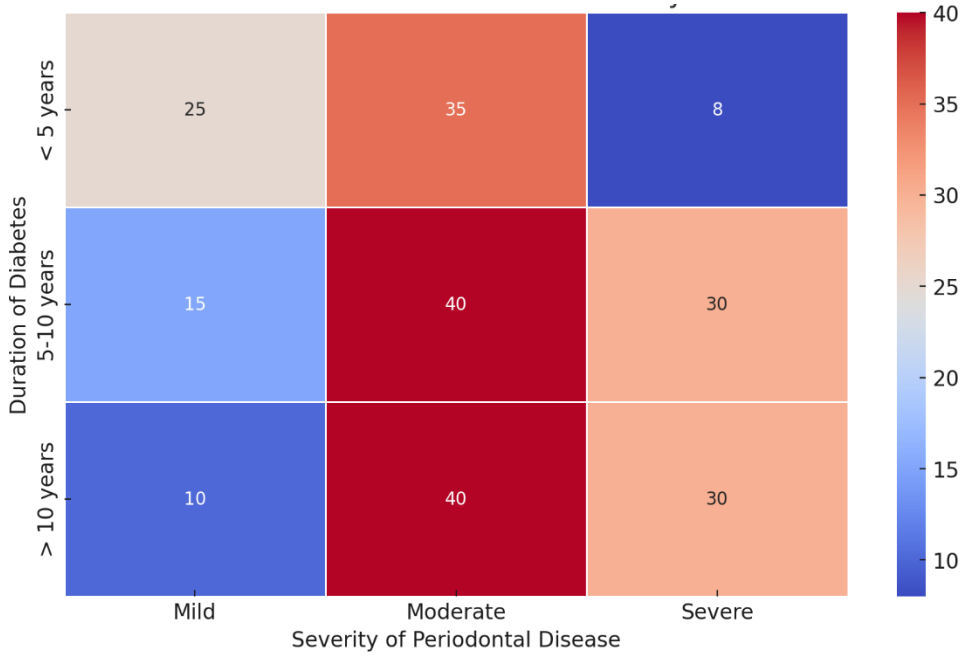

Figure 1: Heatmap of association between duration of DM and severity of periodontal disease

The study revealed that participants with diabetes for less than 5 years most commonly had moderate periodontal disease (16%), followed by 11% with mild and 3.5% with severe disease. Those with diabetes for 5-10 years also showed a higher prevalence of moderate periodontal disease (18%), with 13% having severe and 7% having mild disease. Similarly, participants with diabetes for over 10 years had 18% with moderate periodontal disease, 13% with severe disease, and 4.5% with mild disease.

Table 3:Association Between Duration of Diabetes and Severity of Periodontal Disease

Duration of Diabetes	Severity of Periodontal Disease	Frequency (n=225)	Percentage (%)
<5 years	Mild	25	11%
	Moderate	35	16%
	Severe	8	3.5%
5-10 years	Mild	15	7%
	Moderate	40	18%
	Severe	30	13%
> 10 years	Mild	10	4.5%
	Moderate	40	18%
	Severe	30	13%

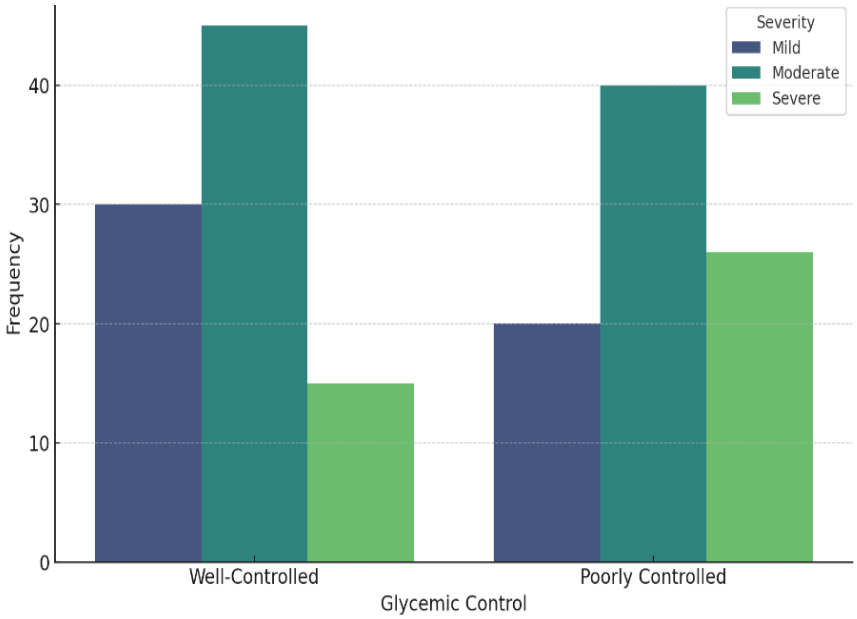

Figure 2: Association between glycemic control and severity of periodontal disease

7. Discussion

The findings of this cross-sectional study highlight the significant prevalence and severity of periodontal disease among diabetic patients in Pakistan. With 78% of the study population exhibiting periodontal disease, the results underscore the profound impact diabetes has on oral health [13]. The correlation between the presence of periodontal diseases and the degree of glycemic control, the duration of the disease, and the level of oral hygiene is evident. Periodontal diseases include a heterogeneous group of immunoinflammatory changes resulting from the host response to bacterial plaque and its products, and they are among the most prevalent oral diseases [14]. These diseases may involve tissues that undergo modifications, such as morphological and biochemical changes on the root surface, affecting glycemic control. Maintaining periodontal tissue health contributes to improved metabolic control, reducing the need for insulin and the levels of glycosylated hemoglobin. Poorly controlled diabetic patients are at a higher risk of developing periodontitis compared to well-controlled and non-diabetic patients [15]. Fairly controlled diabetic patients tend to respond well to treatment, similar to non-diabetic patients. In contrast, poorly controlled patients often exhibit an inadequate response to treatment, with more postoperative complications and less favorable long-term results [16]. Diabetes mellitus is considered an aggravating factor of periodontal disease, with its incidence increasing due to factors such as sedentary lifestyle, obesity, increased life expectancy, and higher survival rates of diabetic patients. Both periodontitis and diabetes are chronic inflammatory diseases with multifactorial etiologies influenced by cytokines. Hyperglycemia plays a significant role in increasing the severity of periodontal disease in diabetic patients [17]. As a result, glycemic control may improve the periodontal condition, and conversely, managing periodontal health can help regulate blood sugar levels. Diabetes mellitus is not a direct cause of periodontal disease but serves as a systemic factor that creates conditions conducive to its development, with bacterial plaque being the primary factor. However, in patients with diabetes and periodontal disease, there is often a negative impact on quality of life [18]. Hyperglycemia associated with diabetes leads to various changes in cells, tissues, and organs, such as decreased collagen synthesis, altered growth factors, increased apoptosis and oxidative stress, deregulated cytokines, and salivary changes [19]. These alterations contribute to the development of periodontal disease and other related illnesses. The relationship between diabetes and oral diseases, particularly periodontal diseases, is evident. While not specific to diabetes, oral manifestations such as gingivitis, periodontitis, xerostomia, delayed wound healing, oral candidiasis, and burning mouth syndrome are more prevalent and progress more rapidly in individuals with poor glycemic control [20,21,22]. The systemic inflammatory burden caused by periodontal infections can worsen glycemic control in diabetic patients by elevating

inflammation markers that interfere with insulin signalling. In turn, poorly controlled diabetes exacerbates periodontal disease due to impaired immune responses and slower tissue healing, creating a cycle of disease progression [23]. Maintaining good oral hygiene and periodontal health is essential in managing diabetes, as it helps stabilize blood glucose levels [24]. Treating periodontitis in diabetic patients has been shown to improve glycemic control, reducing HbA1c levels following periodontal therapy. This emphasizes the need for collaboration between dental and medical professionals to enhance health outcomes for patients affected by both diabetes and periodontal disease [25].

8. Conclusion

This study concludes that periodontal disease is highly prevalent and severe among diabetic patients in Pakistan, with poor glycemic control, longer duration of diabetes, and inadequate oral hygiene significantly contributing to its severity. Integrated care, including routine periodontal assessments and education on oral hygiene, is essential for improving health outcomes in this population.

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