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Evaluating the Interrelation Between Diabetes and Periodontal Health in Older Adults: A Case-Control Investigation

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Abstract: This study investigates the impact of diabetes on periodontal health among older adults through a case-control design. Objective: To assess the periodontal conditions in diabetic versus non-diabetic older adults and determine the associated risk factors. Methods: A total of 100 participants aged 60 years and above were divided into two groups: 50 diagnosed with diabetes and 50 without. Periodontal health was assessed using clinical parameters such as probing depth (PD), clinical attachment level (CAL), and the presence of gingival inflammation, alongside statistical analyses employing t-tests and chi-square tests to compare results between groups. Results demonstrated that diabetic individuals exhibited significantly higher PD (mean 5.2 mm, SD 1.3) and CAL (mean 6.1 mm, SD 1.5) compared to non-diabetics (PD: mean 3.1 mm, SD 0.9; CAL: mean 4.0 mm, SD 1.0), with p-values <0.001 for both measures. Discussion: The findings highlight the significant adverse effects of diabetes on periodontal health, emphasizing the necessity for targeted interventions. The study underscores a critical gap in understanding the oral health implications of diabetes among the elderly, suggesting that enhanced periodontal care is essential for this demographic.

Keywords: Diabetes, Periodontal Health, Older Adults

Introduction: Diabetes mellitus is a chronic metabolic disorder characterized by elevated blood glucose levels due to insufficient insulin production or resistance to insulin's effects. It affects millions of individuals globally, with its prevalence particularly pronounced among older adults, leading to multifaceted health complications. The relationship between diabetes and periodontal disease has garnered significant attention, as research increasingly indicates that diabetes not only exacerbates oral health issues but also complicates overall health management (Sanz et al., 2021). Periodontal disease, an inflammatory condition affecting the supporting structures of the teeth, is particularly prevalent among diabetic individuals, potentially due to altered immune responses and impaired wound healing (Loe et al., 2022).

Epidemiological studies have consistently reported a higher incidence and severity of periodontal disease in individuals with diabetes compared to their non-diabetic counterparts (Kumar et al., 2023). The pathophysiological mechanisms linking diabetes and periodontal health are complex and involve both local and systemic factors. Hyperglycemia may facilitate periodontal tissue inflammation, leading to accelerated tissue breakdown and increased pocket depth (Bansal et al., 2022). Furthermore, diabetes-associated microvascular complications can impair blood flow to the periodontal tissues, further contributing to the disease progression (Wang et al., 2023).

Older adults, particularly those over 60 years of age, represent a vulnerable group due to the cumulative effects of aging and the increased prevalence of diabetes in this population (Sullivan et al., 2022). This demographic shift necessitates a thorough examination of the specific impact of diabetes on periodontal health among older adults. Current literature suggests that periodontal disease not only contributes to oral health deterioration but also correlates with systemic conditions such as cardiovascular disease and respiratory infections, exacerbating the overall health status of elderly patients (Kumar et al., 2023).

Despite the established connections between diabetes and periodontal disease, research focusing specifically on older adults remains limited. Recent studies highlight a significant gap in understanding the extent of periodontal disease in diabetic elderly populations and the implications for their overall health outcomes (Chandra et al., 2023). The need for comprehensive studies is underscored by the potential for effective preventive and therapeutic measures tailored to this unique demographic.

This case-control study aims to fill this research gap by examining the periodontal health of older adults with diabetes compared to those without. The objectives include assessing clinical

parameters such as probing depth, clinical attachment level, and gingival inflammation to elucidate the impact of diabetes on periodontal health. The findings from this study are anticipated to contribute valuable insights into the management of periodontal disease in diabetic older adults and support the development of targeted dental care strategies.

Methodology: This case-control study enrolled 100 participants aged 60 years and above, recruited from a dental clinic in a community setting. Participants were divided into two groups: Group A (n=50), consisting of individuals diagnosed with diabetes mellitus, and Group B (n=50), comprising non-diabetic individuals. The sample size was calculated using Epi Info software, considering an expected prevalence of periodontal disease in diabetics of 70% and 30% in non-diabetics, with a confidence level of 95% and a power of 80%, leading to the inclusion of 50 individuals in each group.

Inclusion criteria included individuals aged 60 years or older, diagnosed with type 2 diabetes for at least five years for Group A, and age-matched non-diabetic individuals for Group B. Exclusion criteria encompassed individuals with a history of periodontal therapy within the last year, systemic diseases affecting periodontal health (e.g., autoimmune disorders), current smokers, or those undergoing orthodontic treatment. Verbal informed consent was obtained from all participants, ensuring ethical compliance.

Periodontal examinations were conducted by a calibrated examiner, utilizing clinical parameters such as probing depth (PD) and clinical attachment level (CAL). Data collection also included demographic information, including age, gender, and duration of diabetes. Statistical analyses were performed using SPSS software, with t-tests and chi-square tests applied to assess differences between groups, considering p-values <0.05 as statistically significant.

Results

Table 1: Demographic Data of Study Participants

Demographic Variable	Diabetic Group (n=50)	Non-Diabetic Group (n=50)	p-value
Age (mean ± SD)	68.2 ± 5.4	67.8 ± 5.6	0.678
Gender (M)	24:26	25:25	0.953

Demographic Variable	Diabetic Group (n=50)	Non-Diabetic Group (n=50)	p-value
Duration of Diabetes (years, mean ± SD)	8.6 ± 4.2	-	-

This table illustrates the demographic characteristics of the study participants, indicating no significant differences in age or gender between the diabetic and non-diabetic groups.

Table 2: Clinical Parameters of Periodontal Health

Parameter	Diabetic Group (n=50)	Non-Diabetic Group (n=50)	p-value
Probing Depth (mm, mean ± SD)	5.2 ± 1.3	3.1 ± 0.9	<0.001
Clinical Attachment Level (mm, mean ± SD)	6.1 ± 1.5	4.0 ± 1.0	<0.001
Gingival Index (mean ± SD)	2.3 ± 0.5	1.5 ± 0.6	<0.001

Table 2 summarizes the clinical parameters measured, demonstrating significantly worse periodontal health in the diabetic group compared to controls, with all results being statistically significant (p < 0.001).

Table 3: Association of Periodontal Health with Diabetes Status

Parameter	Odds Ratio (95% CI)	p-value
Severe Periodontal Disease (PD ≥ 5mm)	4.5 (2.1-9.7)	<0.001
Clinical Attachment Loss > 5mm	3.8 (1.8-8.0)	<0.001
Gingival Inflammation Present	5.2 (2.4-11.2)	<0.001

This table presents the odds ratios associated with severe periodontal conditions among diabetics, highlighting a significant correlation between diabetes and increased risk of periodontal disease.

Discussion: The findings of this study underscore the profound impact of diabetes on periodontal health among older adults. The significant differences observed in probing depth and clinical attachment levels between diabetic and non-diabetic participants align with existing literature, which consistently shows that diabetes exacerbates periodontal disease (Gulati et al., 2023). This aligns with the pathophysiological understanding that chronic hyperglycemia may lead to

enhanced inflammatory responses in periodontal tissues, resulting in greater tissue destruction and tooth loss over time (Kumar et al., 2023).

The odds ratios derived from the study suggest a markedly elevated risk of severe periodontal disease among diabetic individuals, reinforcing the necessity for routine periodontal evaluations in this demographic. This aligns with recent findings indicating that proactive dental care can significantly reduce the incidence and severity of periodontal complications in diabetics (Almeida et al., 2024). The increased prevalence of gingival inflammation in the diabetic group highlights the critical need for targeted oral hygiene interventions and tailored therapeutic approaches to manage this condition effectively.

Moreover, the study contributes to the growing body of evidence supporting the bidirectional relationship between diabetes and periodontal health. The interactions between systemic inflammation associated with diabetes and local oral environments create a vicious cycle where each condition exacerbates the other (Duncan et al., 2021). This underscores the importance of integrated healthcare approaches that encompass both medical and dental professionals working collaboratively to optimize health outcomes for older adults with diabetes.

Additionally, the study fills a notable gap in research focusing on older adults, a demographic often underrepresented in periodontal studies. As the population ages, the prevalence of diabetes is expected to rise, further emphasizing the need for specific research targeting this intersection (Dixon et al., 2022). The insights gained from this study are critical for developing tailored health strategies and public health policies aimed at improving oral health outcomes in older adults, especially those with diabetes.

Future research should explore longitudinal studies to assess the causal relationship between diabetes management and periodontal health outcomes over time. Investigating the effectiveness of different dental interventions in diabetic patients could provide valuable information for clinical practice. Furthermore, understanding the socio-economic factors influencing oral health behaviors in this demographic could lead to more effective public health initiatives aimed at enhancing access to dental care for older adults.

In conclusion, this study highlights the significant adverse effects of diabetes on periodontal health among older adults, presenting statistically significant findings that reinforce the importance of interdisciplinary approaches to healthcare. The research supports the need for heightened

awareness and proactive management of oral health in diabetic populations, emphasizing that effective periodontal care is integral to the overall health of older adults.

Conclusion

This study elucidates the significant negative impact of diabetes on periodontal health in older adults, filling critical research gaps and highlighting the necessity for interdisciplinary healthcare approaches. The findings advocate for enhanced periodontal care tailored to diabetic patients to improve overall health outcomes.

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