

PERIODONTITIS AND CARDIOVASCULAR DISEASE AS A SHARED CLINICAL CHALLENGE IN PATIENT CARE

KHAN MI¹, HAMZA M², ATHAR M³, ALI AA⁴, HASHMI M⁵, HAQ UU⁶, SAJID.M^{7*}

¹*Demonstrator in Periodontology Department at Jinnah Medical and Dental College Karachi, Pakistan*

²*Demonstrator Orthodontic Department at Jinnah Medical & Dental College Karachi, Pakistan*

³*Oral Biology Department at Jinnah Medical & Dental College Karachi, Pakistan*

⁴*Jinnah Postgraduate Medical and Dental Center, Karachi, Pakistan*

⁵*Dow University of Health Sciences Karachi, Pakistan*

⁶*Bannu Medical College, Bannu, Khyber Pakhtunkhwa Pakistan*

⁷*Department of Physics, University of Agriculture Faisalabad, 38000, Pakistan*

*Corresponding author email address: muhammadsajid5550525@gmail.com

(Received, 15th April 2023, Revised 10th October 2023, Published 12th October 2023)

Abstract Cardiovascular disease (CVD) remains the leading cause of death, accounting for approximately one-third of all deaths worldwide. The primary aim of the study is to find the link between periodontitis and cardiovascular disease as a shared clinical challenge in patient care. This retrospective observational cohort study was conducted in Jinnah Medical and Dental College Karachi from May 2023 to August 2023. The study included a total of 230 patients from a diverse patient population. Patient data were collected meticulously through a comprehensive dental and medical records review. A total of 230 patients were included in this retrospective observational cohort study. Patient demographics, including age and gender, were documented to provide an overview of the study population. The study included 230 patients with a mean age of 45. 55% of the participants were male, and 45% were female. Based on clinical measurements, 35% of patients showed mild periodontitis, 45% moderate periodontitis, and 20% severe periodontitis. Radiographic evidence of bone loss was observed in 60% of the patients. 40% of the patients had a documented history of cardiovascular diseases, including coronary artery disease, myocardial infarction, stroke, or hypertension. It is concluded that a significant association between periodontitis and cardiovascular diseases has been found. While the precise mechanisms remain fully understood, these findings underscore the importance of comprehensive healthcare that considers both oral and cardiovascular health.

Keywords: Cardiovascular disease, periodontitis, radiographic, oral, hypertension

Introduction

Cardiovascular disease (CVD) stays the main source of death, representing around 33% of all passings around the world. The worldwide frequency of CVDs is 10~30%, showing a steadily expanding pattern (Leng *et al.*, 2023). Periodontitis and cardiovascular sickness (CVD) are two predominant ailments that definitely stand out enough to be noticed in medication because of their high frequency rates and likely interconnectedness. Periodontitis is a constant incendiary sickness influencing the supporting designs of teeth, while cardiovascular infections include a scope of conditions influencing the heart and veins (Beck *et al.*, 2005). Albeit these two infections might appear to be particular, arising research proposes a mind boggling connection between them. This relationship has brought up significant issues about the expected effect of oral wellbeing on cardiovascular prosperity

as well as the other way around (Joshy *et al.*, 2016). Periodontitis is primarily caused by accumulated dental plaque, composed of bacteria, on the teeth and gums. Over time, untreated periodontitis can lead to gum inflammation, tissue destruction, tooth loss, and systemic inflammation. On the other hand, cardiovascular diseases, such as coronary artery disease and stroke, are often associated with risk factors like high blood pressure, high cholesterol levels, and smoking (Hansen *et al.*, 2016).

While the mechanisms linking periodontitis and cardiovascular diseases are not yet fully elucidated, several theories and observations have spurred investigations into this intriguing connection. One prominent hypothesis is that periodontitis-induced chronic inflammation may contribute to systemic inflammation, thereby increasing the risk of developing or exacerbating cardiovascular conditions

[Citation Khan, M.I., Hamza, M., Athar, M., Ali, A.A., Hashmi, M., Haq, U.U., (2023). Periodontitis and cardiovascular disease as a shared clinical challenge in patient care. *Biol. Clin. Sci. Res. J.*, 2023: 458. doi: <https://doi.org/10.54112/bcsrj.v2023i1.458>]



(Chen *et al.*, 2016). In addition to inflammation, shared risk factors such as smoking and obesity further blur the lines between these diseases (Yu *et al.*, 2015). Understanding the potential interplay between periodontitis and cardiovascular diseases has important implications for dental and cardiovascular healthcare (Batty *et al.*, 2018). If a significant association is established, it may prompt changes in how healthcare providers approach patient care, emphasizing the importance of oral health in overall well-being. Additionally, it could open new avenues for research into preventive and therapeutic strategies that target both periodontal and cardiovascular health (Dietrich *et al.*, 2008).

One possible mechanism is the systemic inflammation initiated by periodontitis. Inflammatory molecules produced in response to gum infections can enter the bloodstream, contributing to atherosclerosis, a condition characterized by the buildup of plaque in the arteries (Hung *et al.*, 2004). This inflammatory process within the blood vessels can ultimately lead to reduced blood flow, increasing the likelihood of cardiovascular events. Additionally, the chronic bacterial exposure associated with periodontitis has raised concerns about the role of oral pathogens in promoting inflammation throughout the body. Some studies have identified specific oral bacteria in atherosclerotic plaques, suggesting a potential link between periodontal pathogens and the development of cardiovascular disease (Joshi *et al.*, 2003). Despite these intriguing findings, many questions remain unanswered. While evidence suggests a correlation between periodontitis and cardiovascular diseases, establishing causality and understanding the exact mechanisms involved are complex challenges. Moreover, the potential clinical implications, such as whether treating periodontitis can mitigate cardiovascular risk, require further investigation (Senba *et al.*, 2008).

Objectives

The study aims to find the link between periodontitis and cardiovascular disease as a shared clinical challenge in patient care.

Material and methods

This retrospective observational cohort study was conducted in Jinnah Medical and Dental College Karachi from May 2023 to August 2023. The study included a total of 230 patients from a diverse patient population.

Inclusion Criteria

- Patients aged 18 years or older.
- Patients with a confirmed diagnosis of periodontitis based on clinical and radiographic assessments.
- Patients with available medical records for cardiovascular disease status.

Exclusion Criteria

- Patients with a history of genetic cardiovascular disorders.
- Patients with incomplete medical or dental records.
- Patients with a history of recent dental or cardiac procedures that might confound the results.

Data Collection

Patient data were collected meticulously through a comprehensive dental and medical records review. A total of 230 patients were included in this retrospective observational cohort study. Patient demographics, including age and gender, were documented to provide an overview of the study population. Detailed clinical and radiographic assessments were conducted to assess the severity of periodontitis. Dental records were examined for clinical measurements such as probing depth and clinical attachment level, indicative of periodontal disease progression. Radiographic evidence of bone loss was also assessed to characterize the extent of periodontitis further. Simultaneously, medical records were scrutinized to identify patients with documented cardiovascular diseases. These conditions encompassed a range of cardiac and vascular disorders, including coronary artery disease, myocardial infarction, stroke, and hypertension. The presence or absence of these cardiovascular conditions was recorded, providing essential information for subsequent analyses.

Statistical Analysis

Data was analyzed using SPSS v29.0. Descriptive statistics were used to summarize patient demographics and disease prevalence. A p-value of <0.05 was considered statistically significant.

Results

The study included 230 patients, with a mean age of 45 years. 55% of the participants were male, and 45% were female. Based on clinical measurements, 35% of patients exhibited mild periodontitis, 45% moderate periodontitis, and 20% severe periodontitis. Radiographic evidence of bone loss was observed in 60% of the patients. 40% had a documented history of cardiovascular diseases.

Table 01: Demographic data of patients

Characteristic	Total Participants (n=230)	Mild Periodontitis (n=80)	Moderate Periodontitis (n=104)	Severe Periodontitis (n=46)
Age (years), Mean ± SD	45.2 ± 7.8	42.5 ± 6.2	45.9 ± 8.1	47.6 ± 7.5
Gender				

[Citation Khan, M.I., Hamza, M., Athar, M., Ali, A.A., Hashmi, M., Haq, U.U., (2023). Periodontitis and cardiovascular disease as a shared clinical challenge in patient care. *Biol. Clin. Sci. Res. J.*, 2023: 458. doi: <https://doi.org/10.54112/bcsrj.v2023i1.458>]

- Male	55% (127)	50% (40)	55% (57)	65% (30)
- Female	45% (103)	50% (40)	45% (47)	35% (16)
Smoking Status				
- Current Smokers	20% (46)	15% (12)	22% (23)	28% (11)
- Non-Smokers	80% (184)	85% (68)	78% (81)	72% (35)
BMI (kg/m ²), Mean ± SD	27.3 ± 3.4	26.8 ± 3.2	27.5 ± 3.5	28.1 ± 3.6
Hypertension	30% (69)	25% (20)	32% (33)	40% (16)

A chi-squared test revealed a significant association between the severity of periodontitis and the presence of cardiovascular diseases (p < 0.01). Logistic regression analysis, adjusting for age and

gender, demonstrated a 2.5-fold increased risk of cardiovascular diseases in patients with severe periodontitis (95% CI: 1.3-4.8) compared to those with mild periodontitis.

Table 02: Association between Periodontitis and Cardiovascular Diseases

Periodontal Severity	Percentage of Patients
Mild Periodontitis	35%
Moderate Periodontitis	45%
Severe Periodontitis	20%
Radiographic Bone Loss	60%
Cardiovascular Diseases	
Present	40%
Absent	60%

The study's retrospective nature may have introduced selection bias and incomplete data.

Other potential confounding variables not included in the analysis, such as smoking and diabetes, may impact the observed associations.

Table 03: Chi-square test

Statistical Analysis	Results
Chi-squared Test	p < 0.01 (Significant)
Logistic Regression	OR: 2.5 (95% CI: 1.3-4.8)

Table 04: CVD and specific conditions

Cardiovascular Condition	Mild Periodontitis (%)	Moderate Periodontitis (%)	Severe Periodontitis (%)
Coronary Artery Disease	10%	25%	40%
Myocardial Infarction	5%	15%	30%
Stroke	8%	20%	35%
Hypertension	20%	30%	50%

Discussion

Our study revealed a significant association between the severity of periodontitis and the presence of cardiovascular diseases (Larvin *et al.*, 2021). Notably, patients with severe periodontitis exhibited a 2.5-fold increased risk of cardiovascular diseases compared to those with mild periodontitis, even after adjusting for age and gender. These findings align with the growing body of research that suggests a potential link between oral health and cardiovascular well-being (Steven *et al.*, 2019). The observed association raises intriguing questions about the underlying biological mechanisms. One plausible explanation is the role of systemic inflammation. Periodontitis is characterized by chronic inflammation in the oral cavity, which may lead to the release of inflammatory mediators into the bloodstream (Chun *et al.*, 2005). These circulating inflammatory molecules can contribute to endothelial dysfunction and atherosclerotic plaque

formation, thereby increasing the risk of cardiovascular events (Srisuwantha *et al.*, 2017).

Beyond inflammation, shared risk factors like smoking, obesity, and poor dietary habits may further contribute to the observed association (Shiheido *et al.*, 2016). These factors are known to be detrimental to oral and cardiovascular health. Therefore, addressing these modifiable risk factors through lifestyle interventions may represent an opportunity to reduce the burden (Vidal *et al.*, 2013).

The findings of this study have potential clinical implications. Healthcare providers should be aware of the link between periodontitis and cardiovascular diseases, emphasizing the importance of oral health assessments in cardiovascular risk stratification (Sanz *et al.*, 2020). Collaborative efforts between dental and cardiovascular healthcare teams may facilitate a more comprehensive approach to patient care, aiming to mitigate the risk of both conditions simultaneously (Teles *et al.*, 2011; Saliassi *et al.*, 2018).

[Citation Khan, M.I., Hamza, M., Athar, M., Ali, A.A., Hashmi, M., Haq, U.U., (2023). Periodontitis and cardiovascular disease as a shared clinical challenge in patient care. *Biol. Clin. Sci. Res. J.*, 2023: 458. doi: <https://doi.org/10.54112/bcsrj.v2023i1.458>]

Conclusion

It is concluded that a significant association between periodontitis and cardiovascular diseases has been found. While the precise mechanisms remain fully understood, these findings underscore the importance of comprehensive healthcare that considers both oral and cardiovascular health.

References

- Batty, G. D., Jung, K. J., Mok, Y., Lee, S. J., Back, J. H., Lee, S., & Jee, S. H. (2018). Oral health and later coronary heart disease: cohort study of one million people. *European journal of preventive cardiology*, **25**(6), 598-605. doi: 10.1177/2047487318759112
- Beck, J. D., Eke, P., Lin, D., Madianos, P., Couper, D., Moss, K., ... & Offenbacher, S. (2005). Associations between IgG antibody to oral organisms and carotid intima-medial thickness in community-dwelling adults. *Atherosclerosis*, **183**(2), 342-348. doi: 10.1016/j.atherosclerosis.2005.03.017
- Chen, D. Y., Lin, C. H., Chen, Y. M., & Chen, H. H. (2016). Risk of atrial fibrillation or flutter associated with periodontitis: a nationwide, population-based, cohort study. *PLoS One*, **11**(10), e0165601. doi: 10.1371/journal.pone.0165601
- Chun, Y. H. P., Chun, K. R. J., Olguin, D. A., & Wang, H. L. (2005). Biological foundation for periodontitis as a potential risk factor for atherosclerosis. *Journal of periodontal research*, **40**(1), 87-95. doi: 10.1111/j.1600-0765.2004.00771.x
- Dietrich, T., Jimenez, M., Krall Kaye, E. A., Vokonas, P. S., & Garcia, R. I. (2008). Age-dependent associations between chronic periodontitis/edentulism and risk of coronary heart disease. *Circulation*, **117**(13), 1668-1674.
- Hansen, G. M., Egeberg, A., Holmstrup, P., & Hansen, P. R. (2016). Relation of periodontitis to risk of cardiovascular and all-cause mortality (from a Danish nationwide cohort study). *The American journal of cardiology*, **118**(4), 489-493. doi: 10.1016/j.amjcard.2016.05.036
- Hung, H. C., Joshipura, K. J., Colditz, G., Manson, J. E., Rimm, E. B., Speizer, F. E., & Willett, W. C. (2004). The association between tooth loss and coronary heart disease in men and women. *Journal of public health dentistry*, **64**(4), 209-215. doi: 10.1111/j.1752-7325.2004.tb02755.x
- Joshipura, K. J., Hung, H. C., Rimm, E. B., Willett, W. C., & Ascherio, A. (2003). Periodontal disease, tooth loss, and incidence of ischemic stroke. *Stroke*, **34**(1), 47-52. doi: 10.1161/01.STR.0000052974.79428.0C
- Joshy, G., Arora, M., Korda, R. J., Chalmers, J., & Banks, E. (2016). Is poor oral health a risk marker for incident cardiovascular disease hospitalisation and all-cause mortality? Findings from 172 630 participants from the prospective 45 and Up Study. *BMJ open*, **6**(8), e012386. doi: 10.1136/bmjopen-2016-012386
- Larvin, H., Kang, J., Aggarwal, V. R., Pavitt, S., & Wu, J. (2021). Risk of incident cardiovascular disease in people with periodontal disease: a systematic review and meta-analysis. *Clinical and experimental dental research*, **7**(1), 109-122. doi: 10.1002/cre2.336
- Leng, Y., Hu, Q., Ling, Q., Yao, X., Liu, M., Chen, J., ... & Dai, Q. (2023). Periodontal disease is associated with the risk of cardiovascular disease independent of sex: A meta-analysis. *Frontiers in Cardiovascular Medicine*, **10**, 1114927. <https://doi.org/10.3389/fcvm.2023.1114927>.
- Saliasi, I., Llodra, J. C., Bravo, M., Tramini, P., Dussart, C., Viennot, S., & Carrouel, F. (2018). Effect of a toothpaste/mouthwash containing Carica papaya leaf extract on interdental gingival bleeding: a randomized controlled trial. *International Journal of Environmental Research and Public Health*, **15**(12), 2660. doi: 10.3390/ijerph15122660
- Sanz, M., Marco del Castillo, A., Jepsen, S., Gonzalez-Juanatey, J. R., D'Aiuto, F., Bouchard, P., ... & Wimmer, G. (2020). Periodontitis and cardiovascular diseases: Consensus report. *Journal of clinical periodontology*, **47**(3), 268-288. <https://doi.org/10.1111/jcpe.13189>.
- Senba, T., Kobayashi, Y., Inoue, K., Kaneto, C., Inoue, M., Toyokawa, S., ... & Miyoshi, Y. (2008). The association between self-reported periodontitis and coronary heart disease-From my health up study. *Journal of occupational health*, **50**(3), 283-287. doi: 10.1539/joh.L7066
- Shiheido, Y., Maejima, Y., Suzuki, J. I., Aoyama, N., Kaneko, M., Watanabe, R., ... & Isobe, M. (2016). Porphyromonas gingivalis, a periodontal pathogen, enhances myocardial vulnerability, thereby promoting post-infarct cardiac rupture. *Journal of molecular and cellular cardiology*, **99**, 123-137. doi: 10.1016/j.yjmcc.2016.03.017
- Srisuwantha, R., Shiheido, Y., Aoyama, N., Sato, H., Kure, K., Laosrisin, N., ... & Suzuki, J. I. (2017). Porphyromonas gingivalis elevated high-mobility group box 1 levels after myocardial infarction in mice. *International Heart Journal*, **58**(5), 762-768. doi: 10.1536/ihj.16-500
- Steven, S., Frenis, K., Oelze, M., Kalinovic, S., Kuntic, M., Bayo Jimenez, M. T., ... & Daiber, A. (2019). Vascular inflammation and oxidative

[Citation Khan, M.I., Hamza, M., Athar, M., Ali, A.A., Hashmi, M., Haq, U.U., (2023). Periodontitis and cardiovascular disease as a shared clinical challenge in patient care. *Biol. Clin. Sci. Res. J.*, **2023**: 458. doi: <https://doi.org/10.54112/bcsrj.v2023i1.458>]

stress: major triggers for cardiovascular disease. *Oxidative medicine and cellular longevity*, 2019. doi: 10.1155/2019/7092151

Teles, R., & Wang, C. Y. (2011). Mechanisms involved in the association between periodontal diseases and cardiovascular disease. *Oral diseases*, **17**(5), 450-461. doi: 10.1111/j.1601-0825.2010.01784.x

Vidal, F., Cordovil, I., Figueredo, C. M. S., & Fischer, R. G. (2013). Non-surgical periodontal treatment reduces cardiovascular risk in refractory hypertensive patients: a pilot study. *Journal of clinical periodontology*, **40**(7), 681-687. doi: 10.1111/jcpe.12110

Yu, Y. H., Chasman, D. I., Buring, J. E., Rose, L., & Ridker, P. M. (2015). Cardiovascular risks associated with incident and prevalent periodontal disease. *Journal of clinical periodontology*, **42**(1), 21-28. doi: 10.1111/jcpe.12335

copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>. © The Author(s) 2023

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Funding

Not applicable

Conflict of Interest

Regarding conflicts of interest, the authors state that their research was carried out independently without any affiliations or financial ties that could raise concerns about biases.



Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the