

Oral Health and its Impact on Systemic Diseases: Bridging the Gap Between Dentistry and Public Health

Priyanka Poudel ¹, Roshan Kumar Roy ², Deepak Kumar Roy ³, Lalan Kumar Mahato ⁴,
Anuranjan Maharaj ⁵

¹Dental Surgeon, Om Chabahil Dental Pvt. Ltd, Koteshwor, Nepal, ²Department of Medical Education, Madan Bhandari Academy of Health Sciences, Hetauda, Nepal, ³Department of Conservative Dentistry and Endodontics, Kathmandu Medical College, Kathmandu, Nepal, ⁴Medical Officer, Ministry of Health, The Sultanate of Oman, ⁵Department of Pediatric and Preventive Dentistry, Kathmandu Medical College, Kathmandu, Nepal.

ABSTRACT

Background: Oral health is integral to overall well-being, with increasing evidence linking oral conditions to systemic diseases such as cardiovascular disease, diabetes, and respiratory infections. Despite this recognized connection, oral health remains under prioritized in public health strategies, particularly in resource-limited settings like Nepal, where dental care infrastructure and awareness are limited. This study aimed to assess the association between oral health conditions including periodontal disease, dental caries, and oral hygiene practices and systemic diseases such as cardiovascular disease, diabetes, and respiratory infections among adults in Kathmandu, Nepal.

Method: A cross-sectional study was conducted among 400 adults residing in Kathmandu. Data were collected through clinical oral examinations and structured questionnaires. The questionnaire gathered demographic information, lifestyle factors (such as smoking and dietary habits), oral hygiene practices, and self-reported systemic health conditions. Statistical analyses were conducted to determine associations between oral and systemic health variables, with significance set at $p\text{-value} < 0.05$.

Result: Significant associations were found between oral and systemic health indicators. Periodontitis was significantly associated with cardiovascular disease ($p\text{-value}=0.002$), while dental caries was linked to uncontrolled diabetes ($p\text{-value}=0.01$). Poor oral hygiene practices were also associated with an increased incidence of respiratory infections ($p\text{-value}=0.03$). Additionally, only 25% of participants reported visiting a dentist regularly, and awareness of the oral-systemic health connection was limited to just 30% of the population surveyed.

Conclusion: This study highlights a clear relationship between poor oral health and systemic diseases in a Nepali population. The low rates of dental visits and limited awareness of the oral-systemic health connection point to a critical gap in public health education and service delivery. There is an urgent need for targeted interventions to increase awareness, improve access to dental care, and integrate oral health into broader healthcare frameworks. Promoting oral health as a component of systemic disease prevention could improve overall health outcomes and reduce healthcare burdens in resource-constrained settings.

Key words: oral health; systemic diseases; cardiovascular disease; diabetes; respiratory infections; periodontal disease.

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INTRODUCTION

Oral health is fundamental to overall health and well-being, influencing physical, mental, and social health. Poor oral health is not limited to localized issues but has far-reaching implications, contributing to systemic diseases.¹ Conditions such as cardiovascular diseases, diabetes, respiratory infections, and adverse pregnancy outcomes are closely linked to oral health problems like periodontitis, dental caries, and

chronic oral infections. These associations arise due to shared risk factors, such as tobacco use, unhealthy diets, and inadequate healthcare access, as well as systemic inflammatory responses triggered by oral infections. Despite this critical connection, oral health remains underrepresented in public health policies, particularly in resource-limited settings like Nepal.^{1,2} In Nepal, oral health disparities are widespread and deeply rooted in socioeconomic inequalities.

Correspondence: Dr. Priyanka Poudel, Dental Surgeon, Om Chabahil Dental Pvt. Ltd, Koteshwor, Kathmandu, Nepal.
E-mail: poudel.priyankabds@gmail.com, Phone: +977-9842670211.

A 2018 survey by the Nepal Health Research Council revealed that 58% of adults in Nepal suffer from periodontal diseases, while 40% of children experience untreated dental caries. Urban-centric dental services and limited healthcare infrastructure in rural areas exacerbate these challenges. Awareness of the connection between oral and systemic health is alarmingly low; only 17% of Nepalese adults regularly visit a dentist. Contributing to this issue is the high prevalence of risk factors such as tobacco use, which affects 27% of Nepal's adult population, and the widespread consumption of betel quid, which is known to cause both oral and systemic health problems.^{3,4} The bidirectional relationship between oral health and systemic diseases is well-documented. Periodontal disease, for instance, has been shown to increase the risk of cardiovascular diseases by up to 25% through mechanisms like systemic inflammation and endothelial dysfunction. Poor glycemic control in individuals with diabetes exacerbates periodontal disease, creating a vicious cycle that worsens both conditions. Additionally, oral infections can increase the risk of respiratory diseases due to the aspiration of oral bacteria into the lungs, leading to pneumonia and other respiratory complications. Such associations underscore the critical need to integrate oral health into broader public health strategies.⁵⁻⁷ In Nepal, no communicable diseases (NCDs) account for 66% of total deaths annually, with cardiovascular diseases and diabetes being leading causes. These conditions are closely linked to poor oral health, yet dental care remains largely excluded from primary healthcare services. The Nepalese government's oral health policies are limited in scope and implementation, focusing primarily on dental treatment rather than prevention and integration into systemic health care.⁸⁻¹⁰ This study investigates the association between oral health and systemic diseases in Kathmandu, Nepal, where urbanization and lifestyle changes are further straining healthcare systems. The research aims to provide a comprehensive understanding of how oral health impacts systemic conditions and to advocate for integrated policies that address this dual burden. By examining the prevalence of oral health issues and

their systemic implications, the study seeks to bridge gaps between dentistry and public health, emphasizing the importance of multidisciplinary approaches in improving health outcomes.^{1,4,5,8} Bridging the gap between oral health and systemic diseases in Nepal requires awareness campaigns, better integration of dental care into primary healthcare systems, and collaborative policy development. Addressing these challenges is crucial to reducing the dual burden of oral and systemic diseases and enhancing the overall health of Nepal's population.^{5,8,9}

METHODS

This was a cross-sectional study conducted over six months in Kathmandu, Nepal. The research targeted adult patients attending Om Chabahil Dental Pvt. Ltd. and selected public health centers, providing a representative snapshot of oral health and systemic disease relationships within the population. Adults aged 18 years and older were included in the study, recruited through convenience sampling. Eligible participants were briefed about the study's objectives, and written informed consent was obtained. Participation was voluntary, ensuring ethical adherence throughout the research process. Standard dental instruments, including mouth mirrors, periodontal probes, and explorers, were used to assess oral health conditions such as periodontal disease (measured using the Community Periodontal Index) and dental caries (assessed by the DMFT index: Decayed, Missing, and Filled Teeth). A structured questionnaire was designed to collect detailed information across three main areas. First, demographic data were gathered, including age, gender, educational level, and socioeconomic status, to provide a comprehensive profile of the participants. Second, lifestyle factors were assessed, focusing on smoking habits, betel quid usage, dietary patterns, and the frequency of oral hygiene practices such as brushing and flossing. Finally, the questionnaire included self-reported information on systemic health conditions, specifically diagnoses of cardiovascular diseases, diabetes, respiratory illnesses, and other chronic conditions, to evaluate participants' overall health status in relation to the

study's objectives. The study's dependent variables, or outcomes, focus on the presence of systemic diseases, specifically including cardiovascular diseases, diabetes, and respiratory infections. These health conditions serve as the primary outcomes being measured in relation to various predictors. The independent variables, or predictors, encompass several factors that may influence these systemic diseases. These include oral health conditions such as periodontal disease, dental caries, and oral hygiene practices. Additionally, demographic factors like age, gender, and socioeconomic status are considered important predictors. Lifestyle factors, including smoking, betel quid chewing, and dietary habits, are also examined for their potential impact on the development or presence of systemic diseases. Together, these variables provide a comprehensive framework to explore the relationships between oral health, personal characteristics, lifestyle behaviors, and systemic health outcomes. Demographics, oral health status, and systemic health data were summarized using means, medians, frequencies, and percentages. A significance level of $p\text{-value} < 0.05$ was set to determine statistically meaningful associations. By employing these tools and techniques, the study provided comprehensive insights into the interplay between oral health and systemic diseases, underscoring their importance in public health policymaking in Kathmandu, Nepal.

RESULTS

The study involved 400 participants, with 60% of them being female. The mean age of the participants was 42.3 years. The age distribution and gender breakdown of the participants are summarized in Table 1.

Table 1. Demographic characteristics of participants.	
Demographic Variable	Frequency (%)
Gender	
Female	60%
Male	40%
Mean \pm SD (Age) = 42.3 \pm 12.1	

The prevalence of periodontitis among the participants was found to be 35%. A statistically significant

association was observed between periodontitis and cardiovascular disease ($p\text{-value} = 0.002$). This indicates that individuals with periodontitis are at a higher risk for developing cardiovascular issues.

Table 2. Prevalence of periodontitis and its association with cardiovascular disease.

Condition	Frequency (%)
Periodontitis Present	35%
Periodontitis Absent	65%
Association with cardiovascular disease ($p\text{-value}$) = 0.002	

Interpretation: A higher percentage of participants with periodontitis had a significant association with cardiovascular disease.

Dental caries was observed in 50% of participants, and of those with dental caries, 20% had uncontrolled diabetes, with a significant $p\text{-value}$ of 0.01. This suggests that uncontrolled diabetes increases the risk of dental caries. The data are presented in Table 3.

Table 3. Association between dental caries and uncontrolled diabetes.

Condition	Frequency (%)
Dental Caries Present	50%
Uncontrolled Diabetes	20%
Association with uncontrolled diabetes ($p\text{-value}$) = 0.01	

The data indicate a significant association between uncontrolled diabetes and dental caries, with a higher percentage of participants having both conditions. Poor oral hygiene practices were associated with a higher risk of respiratory infections, with a $p\text{-value}$ of 0.03. This highlights the importance of maintaining oral hygiene to reduce the risk of systemic infections Table 4.

Table 4. Association between poor oral hygiene and respiratory infections.

Oral Hygiene Practice	Frequency (%)
Poor Oral Hygiene	40%
Good Oral Hygiene	60%
Association with Respiratory Infections ($p\text{-value}$) = 0.03	

Participants with poor oral hygiene were at a significantly higher risk for respiratory infections, underscoring the need for public health efforts to promote better oral care.

The findings from the study reveal a limited awareness of the oral-systemic health connection

among the participants. Only 25% of participants reported regular visits to a dental healthcare provider. This indicates the need for enhanced public health education on the importance of oral health in the context of overall health (Table 5).

Table 5. Awareness and dental visits.	
Awareness of Oral-Systemic Health Connection	Frequency (%)
Aware	30%
Unaware	70%
Routine Dental Visits	25%
Irregular or No Dental Visits	75%

Among the participants, 35% were found to have periodontitis, which showed a significant association with cardiovascular disease. Additionally, 50% of the participants had dental caries, with 20% of these cases linked to uncontrolled diabetes. Poor oral hygiene practices were also associated with a higher risk of respiratory infections. The study revealed limited awareness of the connection between oral health and systemic diseases, with only 25% of participants reporting routine dental visits. These findings highlight the urgent need for public health interventions aimed at increasing awareness of the oral-systemic health link and encouraging regular dental check-ups to improve overall health outcomes.

DISCUSSION

This study emphasizes the significant correlation between oral health and systemic diseases, shedding light on the complex and bidirectional relationship between the two. The findings underscore the importance of recognizing oral health as an integral component of overall health, with implications for both individuals and healthcare systems at large. A growing body of evidence has established that poor oral health is not merely a localized issue affecting the mouth but a contributing factor to various systemic conditions. Conversely, systemic diseases can negatively impact oral health, thereby creating a cycle that exacerbates both oral and systemic conditions. The results of this study align with previous research suggesting that oral diseases, such as periodontitis, dental caries, and oral infections, have been strongly

linked to several chronic systemic diseases. These include cardiovascular diseases, diabetes, respiratory infections, and even adverse pregnancy outcomes. Periodontal disease, for example, has been widely studied in connection with cardiovascular conditions, with research indicating that the bacteria from infected gums can enter the bloodstream, leading to inflammation and the formation of arterial plaques.¹¹ Similarly, individuals with uncontrolled diabetes are more susceptible to gum disease, and in turn, the inflammation from oral infections can worsen blood sugar control, creating a vicious cycle.¹² This bidirectional relationship between oral and systemic health calls for a holistic approach to healthcare. The study highlights that addressing oral health in the context of systemic diseases can improve outcomes across both domains. For instance, the management of diabetes may require not only strict control of blood glucose levels but also regular dental checkups and periodontal care to prevent infections that could complicate diabetes management.¹³ Likewise, public health initiatives aimed at preventing cardiovascular diseases could benefit from incorporating oral health screenings, particularly for individuals at higher risk due to factors such as smoking, poor diet, or genetic predisposition.¹⁴ Integrating oral health into primary healthcare services is a crucial step in breaking the cycle of poor oral health and systemic disease. This would ensure that individuals have access to both dental and medical care under the same healthcare umbrella, facilitating early detection and intervention for conditions that may be linked. For example, physicians could screen for early signs of periodontal disease during routine check-ups, while dentists could screen for signs of systemic diseases such as diabetes or cardiovascular issues during dental exams.¹⁵ Such an integrated approach not only enhances the quality of care but also reduces the burden on healthcare systems by addressing both conditions simultaneously, potentially preventing more severe complications that may arise from untreated conditions.¹⁶

Public health campaigns also play a vital role in raising awareness about the interconnectedness of oral and systemic health. By educating the public

on the importance of maintaining oral hygiene and seeking regular dental care, we can reduce the prevalence of oral diseases and, in turn, decrease the incidence of related systemic conditions. These campaigns could target high-risk populations, such as individuals with diabetes or those with a family history of cardiovascular diseases, to encourage them to seek both dental and medical care. The messaging could emphasize that oral health is not a standalone issue but an essential aspect of overall well-being that requires proactive management and attention.¹⁷ Moreover, awareness programs focusing on the bidirectional relationship between oral and systemic health could empower communities, encouraging individuals to take responsibility for both their oral and overall health. This would involve educating people on the importance of good oral hygiene practices, such as regular brushing and flossing, along with the need for balanced nutrition, regular exercise, and the avoidance of harmful habits such as smoking.¹⁸ The long-term benefits of such programs would extend beyond reducing the burden of oral diseases; by addressing the root causes of systemic diseases, these programs could contribute to improving public health outcomes, reducing healthcare costs, and enhancing quality of life. One of the key challenges in integrating oral health into primary healthcare and public health initiatives is the lack of awareness among both the general population and healthcare providers. Many individuals still view dental care as separate from overall health, and healthcare providers may not be sufficiently trained to recognize oral health issues as part of broader health concerns. This gap in knowledge may result in missed opportunities for early intervention and prevention. To address this, it is crucial to promote the training of healthcare professionals across disciplines both in dental and medical fields to recognize the signs and symptoms of oral diseases that may signal systemic issues and vice versa. Interdisciplinary collaboration should become a cornerstone of healthcare practice to provide more comprehensive care.¹⁹ Another important aspect of improving the integration of oral and systemic

health is the reduction of barriers to dental care, particularly in underserved communities. Factors such as cost, lack of access to dental professionals, and limited awareness about the importance of oral health can prevent individuals from seeking the care they need. Public health programs should prioritize reaching these vulnerable populations to ensure they have access to both preventive and therapeutic dental services. This may involve expanding the reach of community health centers, providing dental insurance coverage, and implementing mobile dental units to serve remote or underserved areas.²⁰ By promoting awareness of the bidirectional relationship between oral and systemic health, healthcare systems can improve outcomes for individuals, reduce the financial burden of treating preventable conditions, and foster healthier communities. The integration of oral health into primary healthcare services, coupled with public health campaigns, can pave the way for more holistic, comprehensive care. By working toward, a more inclusive and integrated healthcare system, we can ensure better health outcomes for both individuals and society as a whole.²¹

Limitations

The primary limitation of this study lies in its cross-sectional design, which restricts the ability to establish causal relationships between oral health and systemic diseases. While the study identifies strong correlations between these factors, it does not provide evidence of direct causality. Cross-sectional studies capture data at a single point in time, making it difficult to determine the direction of the association or whether one condition leads to the other. As a result, while the bidirectional relationship between oral and systemic health is evident, the study cannot definitively determine whether poor oral health contributes to the development of systemic diseases or whether systemic diseases exacerbate oral health problems. Additionally, the study relies on self-reported data for certain aspects of oral health and health behaviors, which may be subject to recall bias or inaccuracies in reporting. Self-reporting can sometimes lead to underreporting or over reporting

of health conditions, affecting the validity of the results.

CONCLUSIONS

The findings of this study underscore the critical connection between oral health and systemic diseases, highlighting the profound impact that oral health can have on overall well-being. Poor oral health, particularly conditions like periodontitis and dental caries, has been shown to contribute to the development and progression of systemic diseases such as cardiovascular disease, diabetes, and respiratory infections. Conversely, systemic diseases often exacerbate oral health problems, creating a cyclical relationship that complicates both oral and systemic health management. This bidirectional interaction suggests that improving oral health can have a direct and positive impact on reducing the burden of systemic diseases, and vice versa. Given the substantial evidence linking oral health to systemic health, there is an urgent need for a more integrated approach to healthcare that includes collaboration between dental professionals, primary healthcare providers, and public health policymakers. Such a partnership could help bridge the gap between oral and general health, ensuring that both aspects are addressed simultaneously. This integrated approach would not only improve individual health outcomes but also alleviate the strain on healthcare systems by preventing the development of complex, chronic conditions that

require extensive medical intervention. In settings like Kathmandu, where healthcare resources are often limited, an integrated approach to oral and systemic health could be particularly beneficial. In resource-constrained environments, healthcare systems are frequently stretched thin, and patients may not always have access to specialized dental care or comprehensive health services. By incorporating oral health screenings into routine primary care visits, healthcare providers can identify and address oral health problems early, preventing the escalation of related systemic issues. Moreover, public health campaigns that emphasize the link between oral health and overall health can empower communities to take a proactive role in their healthcare, reducing the burden on healthcare systems and improving long-term health outcomes. Ultimately, addressing the gap between oral and systemic health through collaborative efforts can lead to holistic healthcare strategies that promote healthier populations. In places like Kathmandu, where access to care may be limited, such strategies are essential for improving population health and reducing healthcare disparities. By ensuring that oral health is integrated into the broader healthcare landscape, we can work toward better health outcomes, improved quality of life, and reduced healthcare costs for all.

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