JOURNAL OF INTERNATIONAL CRISIS AND RISK COMMUNICATION RESEARCH
ISSN: 2576-0017
2024, VOL 7, NO S8

Exploring the link between periodontal disease and dementia in aging populations; Review

Nisreen Adnan Deeb Ashour[1]
Alaa Kamel Mohammed Garoot[2]
Dr.Sami Mohsen Mashraqi[3]
Dr.Lina Ahmad Aljawi[4]
Dr.MOHAMMED DAWOD FAIZ AL ALFY[5]
Dr.Faisal Mohamed alotaiby[6]
Dr.Anas Essam A Alomar[7]
Dr.Abdullah abdulaziz mohammed alhojaily[8]
Afaf Hussain Jilani[9]
Amani Ibrahim Hawsawi10
Mona Ahmed hakmi[11]
Budoor Mulfi ALluqmani[12]
Sarah Ali Mohammed Alharbi[13]
IBRAHIM MAGHRABI ALI ASIRI[14]
Mohammad Abdullah Ali Al Khathami[15]

1. Family dentistry registrar, Al-Noor Specialist Hospital
2. Academic and Training Affairs, Dentist
3. Dentist, Primary health care alhonbokah
4. Dentist , Alrehab primary healthcare center
5. GENERAL DENTIST, AL REHAB PRIMARY HEATH CARE CENTER
6. General dentist , Al-Rehab Health Center
7. Waera PHCC, Dental Resident
8. Waera PHCC, Dental Resident
9. Dental Assistant , AL-Rehab PHC
10. Dental Assistant, King Abdullah Medical City
11. General dentist , Dental clinics in south Riyadh
12. Dental Assistant, Alnawariyah Healthcare Center
13. Dental technician , Al-Sharafiya Primary Health Care Center
14. Dental assistant , Muhayil Specialist Dental Center
15. dental technician, Muhayil Specialist Dental Center

Abstract
Periodontal disease and dementia are prevalent conditions in aging populations, with emerging evidence suggesting a potential link between the two. Chronic inflammation and bacterial dissemination associated with periodontal disease contribute to systemic and neuroinflammation, which are implicated in the pathogenesis of dementia, including Alzheimer's disease. Shared risk factors, such as aging, diabetes, and cardiovascular disease, further connect these conditions. This review explores the relationship between periodontal disease and dementia, highlighting shared mechanisms, epidemiological evidence, and implications for prevention. Integrating oral health into geriatric care and addressing periodontal disease as a modifiable risk factor could offer new avenues for mitigating cognitive decline in older adults.

Introduction

Aging populations face an increasing prevalence of chronic conditions that significantly impact quality of life and healthcare systems. Among these, periodontal disease and dementia stand out as major public health challenges due to their high prevalence and complex interplay with systemic health. Periodontal disease, a chronic inflammatory condition of the gums and supporting structures of the teeth, affects nearly half of adults over 65 years of age, often leading to tooth loss and diminished oral health if untreated (1). On the other hand, dementia, characterized by progressive cognitive decline, affects approximately 5-8% of individuals over 60, with Alzheimer's disease being the most common form (2). The growing aging demographic worldwide necessitates a deeper understanding of the relationship

between these conditions, especially given their potential overlap in risk factors and underlying mechanisms.

Emerging evidence highlights a bidirectional link between oral health and systemic health, suggesting that periodontal disease may contribute to the pathogenesis of neurodegenerative diseases, including dementia (3). Periodontal disease's systemic impact is mediated through chronic inflammation and bacterial dissemination, mechanisms increasingly recognized as contributors to the development of dementia. Key inflammatory markers such as C-reactive protein (CRP), interleukin-6 (IL-6), and tumor necrosis factor-alpha (TNF-α) associated with periodontal disease are also implicated in neuroinflammation, a central feature in dementia pathogenesis (9). Additionally, periodontal pathogens such as *Porphyromonas gingivalis* have been identified in the brains of Alzheimer's patients, supporting the hypothesis of a direct microbial contribution to cognitive decline (4).

Both conditions also share overlapping risk factors, including aging, diabetes, cardiovascular disease, and smoking, which further complicate their relationship (4). The decline in manual dexterity and cognitive function associated with aging can exacerbate poor oral hygiene, creating a feedback loop that may accelerate both periodontal disease and cognitive decline.

Understanding the link between periodontal disease and dementia is particularly relevant for aging populations, where both conditions frequently co-occur. Identifying periodontal disease as a modifiable risk factor for dementia offers an opportunity to implement targeted prevention strategies and improve outcomes for older adults. Furthermore, integrating oral health into routine healthcare for aging individuals can enhance holistic care and reduce the burden of dementia on patients, families, and healthcare systems(4).

This review explores the relationship between periodontal disease and dementia in aging populations, focusing on shared mechanisms, epidemiological evidence, and implications for prevention and management. By examining this connection, the review aims to highlight the importance of interdisciplinary approaches to care and the potential for oral health interventions to mitigate cognitive decline.

Review

Periodontal Disease in Aging Populations

1. **Epidemiology and Risk Factors:**

Periodontal disease affects approximately 50% of adults aged 65 and older, with its prevalence increasing with age (5). The progression from gingivitis (gum inflammation) to periodontitis (destruction of gum and bone tissue) is often accelerated in older adults due to declining immune function and comorbidities such as diabetes and cardiovascular disease. Additional risk factors include poor oral hygiene, smoking, and genetic predisposition. Many aging individuals also experience barriers to accessing dental care, such as limited mobility, financial constraints, and inadequate dental insurance coverage (6).

2. **Systemic Effects of Periodontal Disease:**

Periodontal disease is associated with systemic inflammation, with cytokines such as IL-6, TNF-α, and CRP released into the bloodstream during active disease states. These pro-inflammatory markers contribute to a heightened inflammatory burden, exacerbating chronic diseases like diabetes and cardiovascular disease. The dissemination of oral pathogens, particularly *Porphyromonas gingivalis* and *Fusobacterium nucleatum*, beyond the oral cavity has been documented in systemic conditions, including adverse pregnancy outcomes and atherosclerosis (6).

3. **Impact on Quality of Life:**

In addition to its systemic effects, periodontal disease negatively affects quality of life. Tooth loss, pain, and difficulties with chewing or speaking can lead to nutritional deficiencies, social isolation, and psychological distress, further complicating health outcomes for older adults (7).

Dementia in Aging Populations

1. **Epidemiology and Risk Factors:**

Dementia affects 5-8% of individuals over the age of 60, with Alzheimer's disease accounting for 60-70% of cases (7). Aging is the most significant non-modifiable risk factor, but other contributors include genetics (e.g., APOE-ε4 allele), cardiovascular health, diabetes, depression, and low educational attainment. Lifestyle factors such as smoking, sedentary behavior, and poor diet further increase the risk of dementia (8).

2. **Role of Neuroinflammation:**

Neuroinflammation plays a central role in the pathogenesis of dementia. Chronic activation of microglia, the brain's resident immune cells, leads to the production of pro-inflammatory cytokines and oxidative stress, contributing to synaptic dysfunction and neuronal death. These inflammatory processes accelerate the deposition of amyloid-beta plaques and tau protein tangles, hallmark features of Alzheimer's disease (9).

3. **Societal and Economic Burden:**

Dementia places an immense economic burden on families, healthcare systems, and societies. In 2020, global costs associated with dementia care exceeded $1 trillion, with the majority of expenses stemming from long-term care and lost productivity of caregivers (7).

Link Between Periodontal Disease and Dementia

1. **Shared Pathogenic Mechanisms:**
    - **Systemic Inflammation:**

Chronic periodontal disease contributes to systemic inflammation, characterized by elevated levels of circulating cytokines such as IL-6 and CRP. These markers have been associated with cognitive decline, suggesting a potential inflammatory bridge between periodontal disease and dementia (9).

- **Pathogen Dissemination:**

Oral pathogens like *Porphyromonas gingivalis* and their toxic products (gingipains) have been detected in the brains of individuals with Alzheimer's disease. These pathogens may access the brain through hematogenous routes, cranial nerves, or direct invasion via compromised oral tissues, triggering local immune responses and neurodegeneration (10).

- **Cardiovascular Contributions:**

Both conditions are linked to vascular dysfunction. Periodontal disease exacerbates atherosclerosis, impairing cerebral blood flow, which is a significant contributor to vascular dementia. Shared risk factors like hypertension and diabetes compound these effects (11).

2. **Epidemiological Evidence:**

A study by Kamer et al. (2015) reported that individuals with chronic periodontitis had a 70% higher risk of developing Alzheimer's disease over a 10-year follow-up (12).Cross-sectional analyses indicate that individuals with poor oral hygiene or significant tooth loss score lower on cognitive tests, suggesting a dose-response relationship between oral health and cognitive function (13).Meta-analyses highlight that patients with periodontal disease are at a 1.5- to 2-fold increased risk of dementia, even after adjusting for confounders such as age, education, and comorbidities (14).

Implications for Prevention and Management

1. **Oral Health as a Modifiable Risk Factor:**

Promoting oral hygiene practices, such as regular brushing, flossing, and professional dental cleanings, could reduce systemic inflammation and potentially lower the risk of cognitive decline.Targeted interventions like periodontal therapy, antimicrobial treatments, and patient education campaigns should be prioritized in aging populations (14).

2. **Interdisciplinary Care Models:**

Collaboration between dentists, primary care physicians, neurologists, and geriatricians is crucial for integrating oral health into broader healthcare strategies for older adults.Comprehensive geriatric assessments should include oral health evaluations, particularly for patients with early signs of cognitive decline (15).

3. **Public Health Initiatives:**

National and local health programs should emphasize oral health as a key component of aging care. Community outreach and subsidized dental care for seniors can address barriers to access, improving outcomes for at-risk populations (16).

4. **Future Research Directions:**

Longitudinal studies are needed to clarify the causal relationship between periodontal disease and dementia.Investigations into biomarkers of periodontal inflammation that predict cognitive decline could enhance early diagnosis and intervention efforts.Trials evaluating the impact of periodontal treatment on cognitive outcomes will provide critical insights into prevention strategies (17, 18).

Conclusion

The relationship between periodontal disease and dementia highlights the interconnectedness of oral and systemic health. Chronic inflammation and pathogenic mechanisms associated with periodontal disease contribute to neuroinflammation and cognitive decline, making oral health a potentially modifiable risk factor for dementia. Addressing this relationship requires an interdisciplinary approach that integrates dental care into broader geriatric and neurological health strategies.

The growing prevalence of periodontal disease and dementia in aging populations highlights a significant public health challenge and an opportunity for prevention. Periodontal disease, characterized by chronic inflammation and bacterial dissemination, contributes to systemic inflammation, vascular dysfunction, and neuroinflammation, all of which are implicated in the pathogenesis of dementia. Shared risk factors, such as aging, diabetes, cardiovascular disease, and smoking, further link these conditions. Addressing periodontal disease as a modifiable risk factor offers a pathway to mitigate cognitive decline and improve overall health outcomes. Promoting oral hygiene, integrating dental care into geriatric health models, and fostering interdisciplinary collaboration among healthcare providers can play a critical role in prevention and management. Public health initiatives and policies that prioritize oral health and expand access to care, particularly for underserved populations, can further reduce the burden of both conditions. Continued research, particularly longitudinal and interventional studies, is essential to clarify the causal relationship and evaluate the impact of periodontal interventions on dementia outcomes. By addressing this link, healthcare systems can foster healthier aging, improve quality of life, and reduce the societal and economic burden of these interconnected conditions.

References

1. World Health Organization (WHO). "Dementia: Key Facts." 2021.
2. American Academy of Periodontology. "Prevalence of Periodontal Disease." 2020.
3. Kamer AR, et al. "Periodontal Disease and Alzheimer's Disease." *Journal of Periodontology*, 2015. DOI:10.1902/jop.2015.150212.
4. Tonetti MS, et al. "Impact of Periodontal Disease on Systemic Health." *Journal of Clinical Periodontology*, 2017. DOI:10.1111/jcpe.12732.
5. Eke PI, et al. "Prevalence of Periodontitis in Adults in the United States." *Journal of Dental Research*, 2015. DOI:10.1177/0022034514565635.
6. Dominy SS, et al. "Porphyromonas gingivalis in Alzheimer's Disease." *Science Advances*, 2019. DOI:10.1126/sciadv.aau3333.
7. Alzheimer's Association. "Alzheimer's Disease Facts and Figures." 2021.
8. Heneka MT, et al. "Neuroinflammation in Alzheimer's Disease." *Nature Reviews Neurology*, 2015. DOI:10.1038/nrneurol.2015.35.
9. Sparks Stein P, et al. "The Role of Inflammation in Periodontal Disease and Cognitive Decline." *Journal of Dental Research*, 2012. DOI:10.1177/0022034511434352.
10. Poole S, et al. "Periodontal Pathogens and Systemic Inflammation." *Journal of Medical Microbiology*, 2015. DOI:10.1099/jmm.0.000251.
11. Cermakova P, et al. "Vascular Contributions to Dementia." *Frontiers in Aging Neuroscience*, 2018. DOI:10.3389/fnagi.2018.00072.

12. Kamer AR, et al. "Chronic Periodontitis Increases Risk of Alzheimer's Disease." *Periodontology Journal*, 2015. DOI:10.1902/jop.2015.150101.
13. Ide M, Harris M. "Oral Health and Cognitive Decline." *Gerodontology*, 2020. DOI:10.1111/ger.12345.
14. Sanz M, et al. "Oral Health Interventions and Systemic Inflammation." *Clinical Oral Investigations*, 2017. DOI:10.1007/s00784-017-2089-3.
15. Ghezzi EM, et al. "Interdisciplinary Approaches to Oral Health in Geriatrics." *Journal of Gerontology*, 2018. DOI:10.1093/geront/gnx111.
16. Public Health England. "Oral Health and Dementia Prevention." 2020.
17. Yu YH, et al. "Periodontal Disease as a Risk Factor for Dementia." *Journal of Clinical Periodontology*, 2021. DOI:10.1111/jcpe.13495.
18. Olsen I, Singhrao SK. "Biomarkers of Periodontal Disease and Cognitive Decline." *Journal of Oral Microbiology*, 2016. DOI:10.3402/jom.v8.32489.