International Journal Dental and Medical Sciences Research
Volume 7, Issue 3, May - June 2025 pp 146-150 www.ijdmsrjournal.com ISSN: 2582-6018

Exploring the Link between Dementia and Periodontal Disease

Dr. Shreekala Subhash Borker
[1] Consultant Periodontist

.

Date of Submission: 01-06-2025 Date of Acceptance: 11-06-2025

ABSTRACT: Growing evidence suggests a potential link between periodontal disease and cognitive decline, particularly dementia, including Alzheimer's disease (AD). Periodontal disease, a chronic inflammatory condition of the oral cavity, has been associated with systemic inflammation and various extraoral pathologies. Concurrently, dementia remains a significant and escalating public health concern, with projections indicating over 150 million affected individuals by 2050. Emerging research indicates that oral pathogens and their inflammatory byproducts may contribute to neuroinflammation and neurodegenerative processes. The relationship is further complicated by the bidirectional nature of disease progression; cognitive decline impairs oral hygiene practices, potentially exacerbating periodontal disease and systemic inflammation. As dementia advances, reductions in motor skills and self-care capacity increase the prevalence and severity of oral health issues. This review aims to evaluate current scientific literature exploring the pathophysiological, epidemiological, and clinical intersections between periodontal disease and dementia. A clearer understanding of this relationship may offer novel insights into preventive and therapeutic approaches aimed at mitigating cognitive decline through the maintenance of oral health.

KEYWORDS:Dementia, Periodontal disease, neuroinflammation, P. gingivalis

I. INTRODUCTION

The intersection of oral health and systemic well-being has garnered increasing attention in recent years, particularly concerning the potential relationship between periodontal disease and cognitive decline, including dementia.[1] Periodontal disease, a chronic inflammatory condition affecting the supporting tissues of the teeth, has been linked to a variety of systemic diseases, highlighting the critical importance of oral health in overall health maintenance.[2]

Dementia, a syndrome characterized by progressive cognitive decline, poses a significant public health challenge worldwide, with Alzheimer's disease (AD) being its most prevalent form. The global burden of dementia is increasing rapidly, with projections estimating over 150 million cases by 2050.[3] Increasing research has highlighted a potential association between periodontal disease and cognitive decline, suggesting that oral pathogens and their byproducts may contribute to neuroinflammation and the progression of dementia.[4] The challenges associated with maintaining oral hygiene in individuals with dementia further complicate this relationship, potentially exacerbating the impact of periodontal disease on cognitive function.[5] Oral health problems become increasingly prevalent in older people with dementia; as the disorder progresses, cognition, motor skills, and self-care decline, increasing the risk of oral health problems.[6]

The exploration of this connection necessitates a comprehensive understanding of the underlying mechanisms, risk factors, and potential interventions that can mitigate the adverse effects of periodontal disease on cognitive health. This review aims to explore the current scientific evidence regarding the relationship between dementia and periodontal disease, shedding light on the potential implications for both prevention and treatment strategies.

II. PATHOPHYSIOLOGICAL MECHANISMS LINKING PERIODONTAL DISEASE AND DEMENTIA (11 BOLD)

1. **Systemic Inflammation**

Periodontal disease induces a systemic inflammatory response characterized by elevated levels of pro-inflammatory cytokines such as IL-6, IL-1β, TNF-α, and CRP. These inflammatory mediators can disrupt the blood-brain barrier, facilitating neuroinflammation and contributing to neurodegenerative processes associated with dementia.[7]

2. **Direct Bacterial Invasion**

Pathogenic oral bacteria, notably Porphyromonas gingivalis, can enter the bloodstream and potentially cross the blood-brain barrier. Once in the brain, these bacteria may trigger inflammatory responses,

International Journal Dental and Medical Sciences Research
Volume 7, Issue 3, May - June 2025 pp 146-150 www.ijdmsrjournal.com ISSN: 2582-6018

leading to the formation of amyloid plaques and tau tangles—hallmarks of AD.[8]

3. **Oral Microbial Products**

Oral bacteria release outer membrane vesicles (OMVs) containing lipopolysaccharides (LPS) and gingipains, which can penetrate the blood-brain barrier. These OMVs may activate microglia, leading to neuroinflammation and neuronal damage, thereby contributing to cognitive decline.[9]

4. **Tooth Loss and Cognitive Decline**

Tooth loss resulting from periodontal disease is associated with an increased risk of cognitive decline and dementia. The loss of teeth may impair masticatory function, potentially leading to reduced cognitive stimulation and nutritional intake, which are important for maintaining cognitive health.[10]

5. **Bidirectional Relationship**

There is evidence suggesting a bidirectional relationship between periodontal disease and dementia. While periodontal disease may contribute to the onset and progression of dementia, cognitive decline associated with dementia may impair oral hygiene practices, leading to the worsening of periodontal health. Dementia may worsen oral hygiene, leading to progression of periodontitis, forming a feedback loop.[11]

III. STUDIES ON THE ASSOCIATION BETWEEN PERIODONTITIS AND DEMENTIA (

Study	Year	Sample Size	Key Findings
Hategan et al. [12]	2021	40 adults	Subjects with periodontitis exhibited significantly lower scores on cognitive tests, particularly those with aggressive periodontitis.
Montoya et al.[13]	2020	309 adults	Certain inflammatory biomarkers were significantly associated with cognitive impairment in individuals with periodontitis.
Choi et al.[14]	2019	262,349 adults	Chronic periodontitis was associated with increased risk of overall dementia, Alzheimer's disease, and vascular dementia.
Stewart et al.[15]	2013	1,171 adults	Gingival inflammation was strongly associated with cognitive decline over 3 to 5 years.
Noble et al.[16]	2009	2,355 adults	Higher levels of Porphyromonas gingivalis IgG were linked to poorer delayed verbal memory and impaired subtraction abilities.

A table that summarizes current research on the relationship between periodontal disease and dementia or cognitive impairment.

Study	Population	Key Findings	(Author, Year)
Meta-analysis of the correlation between periodontal health and cognitive impairment in the older population, 2024	22 studies, 4,246,608 participants	Poor periodontal health (periodontitis, tooth loss, compromised occlusal support) significantly associated with cognitive impairment	Y-D Fu et al 2024[17]
Periodontitis and low cognitive performance, 2023	2,086 U.S. adults (≥60 years)	Moderate/severe periodontitis linked to low cognitive performance (DSST, AFT, global cognition)	Crystal Marruganti et al 2023[18]

Association between periodontitis and cognitive impairment in adults, 2023	Adults	Chronic periodontitis associated with cognitive impairment; inflammatory biomarkers implicated	Lata Goyal et al 2023[19]
Association between periodontal disease and cognitive impairment in adults, 2023	Adults	Periodontal disease linked to cognitive impairment; gingival inflammation and attachment loss significant	Najwane Said-Sadier et al 2023[20]

These studies collectively suggest a potential association between periodontitis and cognitive decline, though the exact nature of this relationship requires further investigation.

IV. TREATMENT MODALITIES

Treatment Modalities	Description	Author, Year
Mechanical Debridement (Scaling & Root Planing)	Removal of plaque and calculus to reduce bacterial load and systemic inflammation.	Ide et al., 2016[4]
Antimicrobial Therapy	Use of topical (chlorhexidine) or systemic antibiotics to control periodontal pathogens.	Kinane et al., 2017[21]
Host Modulation Therapy	Sub-antimicrobial dose doxycycline to reduce matrix metalloproteinases and inflammation.	Golub et al., 2001[22]
Laser / Photodynamic Therapy	Adjunctive treatment to reduce biofilm and periodontal pathogens.	Al Habashneh et al., 2020[23]
Anti-inflammatory Treatment	NSAIDs and other agents targeting neuroinflammation (experimental/limited efficacy).	Heneka et al., 2015[24]
Neuroprotective Agents	Cholinesterase inhibitors (donepezil) and memantine to manage AD symptoms.	Birks, 2006[25]
Nutritional Support	Omega-3 fatty acids, antioxidants to reduce inflammation and support cognition.	Yurko-Mauro et al., 2010[26]
Prosthetic Rehabilitation	From complete RDPs to IR-RDP, there were improvements in OHQoL and masticatory function.	Tan D et al, 2020[27]
Gingipain Inhibitors (Experimental)	Small molecules targeting P. gingivalis proteases implicated in AD pathology.	Dominy et al., 2019[8]

V. CONCLUSION

Current evidence from cross-sectional and longitudinal studies highlights a significant association between periodontitis and cognitive decline, including dementia. The underlying pathophysiological mechanisms likely involve systemic inflammation, bacterial translocation, and immune-mediated neurodegeneration. While periodontal therapy shows promise in reducing systemic inflammatory burden and potentially mitigating cognitive impairment, more rigorous interventional studies are needed to establish causality and therapeutic efficacy. Integrating oral health management into dementia prevention strategies could offer a novel, multidisciplinary approach to improving cognitive health in aging populations. Continued research into the molecular and microbiological links between oral and brain health will be crucial for developing targeted interventions.

REFERENCES

[1]. Guo H, Chang S, Pi X, Hua F, Jiang H, Liu C, Du M. The Effect of Periodontitis on Dementia and Cognitive Impairment: A Meta-Analysis. Int J Environ Res Public Health. 2021:25;18(13):6823.

[2]. Kapila YL. Oral health's inextricable connection to systemic health: Special populations bring to bear multimodal relationships and factors connecting periodontal disease to systemic diseases and conditions. Periodontol 2000. 2021;87(1):11-16.

[3]. Nichols E, Steinmetz JD, Vollset SE, et al. Estimation of the global prevalence of dementia in 2019 and forecasted prevalence in 2050: an analysis for the Global Burden of Disease Study 2019. Lancet Public Health. 2022;7(2):105-25.
[4]. Ide M, Harris M, Stevens A, et al. Periodontitis and cognitive decline in Alzheimer's disease. PLoS One. 2016;11(3):0151081.
[5]. Lauritano D, Moreo G, Della Vella F, Di Stasio D, Carinci F, Lucchese A, Petruzzi M. Oral Health Status and Need for Oral Care in an Aging Population: A Systematic Review. Int J Environ Res Public Health. 2019;16(22):4558.
[6]. Delwel S, Binnekade TT, Perez RS, Hertogh CM, Scherder EJ, Lobbezoo F. Oral health and orofacial pain in older people with dementia: a systematic review with focus on dental hard tissues. Clin Oral Investig. 2017;21(1):17-32.
[7]. Kamer AR, Craig RG, Dasanayake AP, Brys M, Glodzik-Sobanska L, de Leon MJ. Inflammation and Alzheimer's disease: possible role of periodontal diseases. Alzheimers Dement. 2008;4(4):242-50.
[8]. Dominy SS, Lynch C, Ermini F, Benedyk M, Marczyk A, Konradi A, Nguyen M, Haditsch U, Raha D, Griffin C, Holsinger LJ, Arastu-Kapur S, Kaba S, Lee A, Ryder MI, Potempa B, Mydel P, Hellvard A, Adamowicz K, Hasturk H, Walker GD, Reynolds EC, Faull RLM, Curtis MA, Dragunow M, Potempa J. Porphyromonas gingivalis in Alzheimer's disease brains: Evidence for disease causation and treatment with small-molecule inhibitors. Sci Adv. 2019;23:5(1).
[9]. Poole S, Singhrao SK, Chukkapalli S, Rivera M, Velsko I, Kesavalu L, Crean S. Active invasion of Porphyromonas gingivalis and infection-induced complement activation in ApoE-/- mice brains. J Alzheimers Dis. 2015;43(1):67-80.
[10]. Chen J, Ren CJ, Wu L, Xia LY, Shao J, Leng WD, Zeng XT. Tooth Loss Is Associated With Increased Risk of Dementia and With a Dose-Response Relationship. Front Aging Neurosci. 2018;10:415.
[11]. Harding A, Singhrao SK. Periodontitis and Dementia: A Bidirectional Relationship? J Dent Res. 2022;101(3):245-6.
[12]. Noble JM, Borrell LN, Papapanou PN, Elkind MS, Scarmeas N, Wright CB. Periodontitis is associated with cognitive impairment among older adults: analysis of NHANES-III. J Neurol Neurosurg Psychiatry. 2009;80(11):1206-11.
[13]. Hategan SI, Kamer SA, Craig RG, Sinescu C, de Leon MJ, Jianu DC, Marian C, Bora BI, Dan TF, Birdac CD, Marcu A, Kamer AR, Negrutiu ML. Cognitive dysfunction in young subjects with periodontal disease. Neurol Sci. 2021;42(11):4511-9.
[14]. Choi S, Kim K, Chang J, Kim SM, Kim SJ, Cho HJ, Park SM. Association of Chronic Periodontitis on Alzheimer's Disease or Vascular Dementia. J Am Geriatr Soc. 2019;67(6):1234-9.
[15]. Stewart R, Weyant RJ, Garcia ME, Harris T, Launer LJ, Satterfield S, Simonsick EM, Yaffe K, Newman AB. Adverse oral health and cognitive decline: the health, aging and body composition study. J Am Geriatr Soc. 2013;61(2):177-84.
[16]. Gil Montoya JA, Barrios R, Sanchez-Lara I, Ramos P, Carnero C, Fornieles F, Montes J, Santana S, Luna JD, Gonzalez-Moles MA. Systemic inflammatory impact of periodontitis on cognitive impairment. Gerodontology. 2020;37(1):11-8.
[17]. Fu YD, Li CL, Hu CL, Pei MD, Cai WY, Li YQ, Xu L, Zeng Y. Meta Analysis of the Correlation between Periodontal Health and Cognitive Impairment in the Older Population. J Prev Alzheimers Dis. 2024;11(5):1307-15.
[18]. Marruganti C, Baima G, Aimetti M, Grandini S, Sanz M, Romandini M. Periodontitis and low cognitive performance: A population-based study. J Clin Periodontol. 2023;50(4):418-29.
[19]. Goyal L, Gupta S, Perambudhuru Y. Association between periodontitis and cognitive impairment in adults. Evid Based Dent. 2023;24(3):123-4.
[20]. Said-Sadier N, Sayegh B, Farah R, Abbas LA, Dweik R, Tang N, Ojcius DM. Association between Periodontal Disease and Cognitive Impairment in Adults. Int J Environ Res Public Health. 2023;20(6):4707.

[21]. Kinane DF, Stathopoulou PG, Papapanou PN. Periodontal diseases. Nat Rev Dis Primers. 2017;3:17038.
[22]. Golub, L.M., McNamara, T.F., Ryan, M.E., Kohut, B., Blieden, T., Payonk, G., Sipos, T. and Baron, H.J. Adjunctive treatment with subantimicrobial doses of doxycycline: Effects on gingival fluid collagenase activity and attachment loss in adult periodontitis. Journal of Clinical Periodontology. 2001;28:146-56.
[23]. Al Shbool BD, Habashneh RA, Ta'ani DS, Alzoubi MM. Clinical Effectiveness of Diode Laser as an Adjunct in the Treatment of Periodontitis. Int J Oral Dent Health. 2021;7(4):137.
[24]. Heneka MT, Carson MJ, El Khoury J, Landreth GE, Brosseron F, Feinstein DL, Jacobs AH, Wyss-Coray T, Vitorica J, Ransohoff RM, Herrup K, Frautschy SA, Finsen B, Brown GC, Verkhratsky A, Yamanaka K, Koistinaho J, Latz E, Halle A, Petzold GC, Town T, Morgan D, Shinohara ML, Perry VH, Holmes C, Bazan NG, Brooks DJ, Hunot S, Joseph B, Deigendesch N, Garaschuk O, Boddeke E, Dinarello CA, Breitner JC, Cole GM, Golenbock DT, Kummer MP. Neuroinflammation in Alzheimer's disease. Lancet Neurol. 2015;14(4):388-405.
[25]. Birks J. Cholinesterase inhibitors for Alzheimer's disease. Cochrane Database Syst Rev. 2006;(1).
[26]. Yurko-Mauro K, McCarthy D, Rom D, Nelson EB, Ryan AS, Blackwell A, Salem N Jr, Stedman M; MIDAS Investigators. Beneficial effects of docosahexaenoic acid on cognition in age-related cognitive decline. Alzheimers Dement. 2010;6(6):456-64.
[27]. Tan D, Foster S, Korgaonkar MS, Oxenham V, Whittle T, Klineberg I. The role of progressive oral implant rehabilitation in mastication, cognition and oral health-related quality of life outcomes-A pilot to define the protocol. J Oral Rehabil. 2020;47(11):1368-81.