International Journal in Physical and Applied Sciences
Volume 13 Issue 02, Feb 2026 ISSN: 2394-5710 Impact Factor: 8.202
Journal Homepage: http://ijmr.net.in, Email: irjmss@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal

"Connection Between Oral Inflammatory Diseases and Neurodegenerative Conditions: A Systematic Review of Emerging Evidence"

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ABSTRACT

Background: There has been an increasing interest in the relation between neurodegenerative diseases and oral diseases. There are studies that have proved a connecting link between poor oral health and diseases like Alzheimer's disease or other neurodegenerative disorders.

Aim: The aim of the study is to find a strong correlation between neurodegenerative conditions and oral health.

Methodology: A systematic search of English-language literature was conducted across electronic databases, including PubMed, Scopus, Web of Science, and Cochrane Library. Studies published between 2012 and 2025 examining the relationship between oral inflammatory diseases (periodontitis, oral dysbiosis, chronic gingival inflammation) and neurodegenerative disorders (Alzheimer's disease, dementia, Parkinson's disease) were included. Both observational and review-based evidence were analzed using thematic synthesis.

Results: There is a strong relation between poor oral health, inflammatory oral conditions, and increased risk of neurodegenerative disorders. Major risk factors included systemic inflammation, oral microbial translocation, and neuroinflammation by cytokines. Another risk factor discovered is the presence of specific pathogens like *Porphyromonas gingivalis*, which is strong evidence to prove the bidirectional relationship between neurodegenerative diseases and oral health.

Conclusion:
Oral health and oral inflammatory diseases are the risk factors that can be modified to prevent and manage the progression of neurodegenerative diseases. Integration of this knowledge into preventive healthcare and geriatric care is essential for its successful implementation and to reduce the global burden of neuroinflammatory diseases. If implemented well into healthcare practices, it can help in improving health outcomes.

KEY WORDS: Alzheimer's disease, neurodegenerative disease, neurodegenerative disorders, oral diseases, oral-brain axis, Parkinson's disease.

MANUSCRIPT

INTRODUCTION

Oral health has the ability to influence our overall health. Long-standing inflammation and microbial dysbiosis often lead to chronic inflammatory diseases like gingivitis and periodontitis, which further lead to destruction of periodontal tissues. It was initially thought that oral diseases are only limited to the oral cavity, but recent studies have proved that there is a strong relation between systemic health and overall health. Some of the examples are conditions like diabetes mellitus, cardiovascular diseases, and adverse pregnancy outcomes, which are affected by oral health. Among the older population, conditions like Alzheimer's disease and Parkinson's disease contribute majorly to the global health burden. [1] These conditions lead to progressive neuronal loss, cognitive decline, and chronic neuroinflammation. The primary risk factors are mainly age and genetics, but other risk factors also contribute significantly to the progression of the disease. Chronic periodontal inflammation becomes the main reason for long-term systemic inflammation. This may lead to the release of inflammatory mediators and pathogenic microorganisms, which are capable of homeostasis. These were only hypotheses until recent studies showed the presence of oral pathogens in the brain tissues of people with Alzheimer's disease. [2-3]

Strong evidence is still required in the fields of dentistry, neurology, and immunology to gain clarity on the relation between systemic conditions and oral health. This association can be relevant for practical use once there is clarification on the data. The literature is synthesized for dentists who contribute to healthcare in the early detection and management of diseases.

METHODOLOGY

A systematic literature review was carried out by using multiple electronic databases like PubMed, Scopus, Cochrane Library, and Web of Science. Various research articles and publications of the last 13 years were studied. Therefore, the search included published studies from January 2012 to March 2025. The search included the use of keywords like 'Alzheimer's disease', 'neurodegenerative disease', 'neurodegenerative disorders', 'oral diseases', 'oral-brain axis', and 'Parkinson's disease'.

Articles in the English language were included. Articles under the categories of systematic literature review, narrative review, umbrella review, cohort study, case-control study, and cross-section study were included. Multiple studies and literature that involve topics of oral inflammatory conditions as well as neurodegenerative conditions were thoroughly evaluated. The exclusion criteria were animal-based studies, case reports without primary data, and studies that did not address any inflammatory or microbial mechanisms. Study selection included titles and abstracts extraction, which were most relevant to the present topic. It was followed by a full text evaluation. The data, including the design of the study,

oral health characteristics, neurodegenerative associations, and possible mechanisms, was synthesized.

RESULTS

The current literature has established a strong relation between chronic periodontitis and increased risk of Alzheimer's disease, Parkinson's disease, and dementia. [4] The severity of any neurodegenerative disorder tends to increase in case of persistent oral inflammation. Especially in geriatric patients, the cognitive outcomes may become worse in the presence of periodontal diseases. Therefore, it is said that systemic inflammation acts like a connecting link between poor oral health and neurodegenerative diseases. The levels of inflammatory mediators like cytokines, interleukin-1β, IL-6, TNF-α, and C-reactive protein are increased in case of chronic inflammation. These mediators are also responsible for brain inflammation. The entire phenomenon leads to neural damage and a gradual reduction in the mental abilities. It also hampers activities like thinking ability, memory power, reasoning, attention, and decision-making. Oral dysbiosis and increased bacterial load are associated with the severity and progression of neurodegenerative disease. [5] The literature has established a bidirectional relation between oral health and neurodegenerative diseases. It also has confirmed the oral-brain axis. Many of the evidence-based studies have proven that to decrease the probability of neurodegenerative diseases, it is important to maintain good oral health. Steps like regular toothbrushing, flossing, and frequent dental visits should be incorporated into day-to-day routines to achieve the desired outcomes.

DISCUSSION

This review shows that there is a lot of evidence that inflammatory diseases and neurodegenerative conditions are connected. Inflammatory diseases and neurodegenerative conditions are linked in many ways. Conditions like Alzheimer's disease, Parkinson's disease, and dementia are discussed, which fall among the most common neurological disorders in older populations. [6] The review supports the existence of the oral-brain axis. It also supports the fact that oral health is crucial for our brain health. The condition of the mouth is supposed to affect pre-existing inflammatory and neurodegenerative conditions. In case of conditions like chronic periodontitis, there is persistent inflammation and release of mediators like interleukin-1β, IL-6, TNF-α, and C-reactive protein. The inflammatory markers are the center for neuroinflammatory processes, which further lead to neuronal damage and cognitive decline. [7-8]

The literature suggests that any oral inflammation that is retained over a long period of time may contribute to neurodegenerative pathologies. These pathologies are said to exacerbate brain inflammation and neuron loss. Further, mechanisms like microbial translocation and oral dysbiosis connect oral health to neurological health. *Porphyromonas gingivalis*, a periodontal pathogen, is detected in the brain tissues of patients with Alzheimer's disease. [9] Further, these pathogens and their virulence also promote activities like immune

activation, neurotoxicity, and amyloid-related pathologies. This phenomenon also supports the role of oral infection in neurodegeneration. A bidirectional relationship exists between oral health and neurodegenerative diseases. Firstly, the presence of periodontal diseases increases the risk of cognitive impairment. On the other hand, compromised oral care worsens the periodontal health. This constant loop between oral health and worsened cognitive outcomes needs early and preventive dental care, especially in the geriatric population. From a clinical point of view, oral diseases are the conditions that can be modified and can be used as a protection against neurodegenerative diseases if managed well. To achieve this scenario, frequent dental visits, periodontal management, and maintenance of oral hygiene are required. This may automatically reduce potential systemic inflammation. If we want to actually improve overall health outcomes, especially in geriatric patients, it is important to incorporate this information into practical use. [10] Although there is enough evidence based on this concept, a lot of it is only based on observation. Being heterogeneous in nature, it is entirely based on different types of methods and designs. We need more longitudinal and interventional studies to establish a stronger correlation between periodontal treatment and its effects on neurodegenerative outcomes. Oral health can be used as a modifiable health factor, which can be used to reduce the global health burden.

LIMITATIONS

The understanding of literature is quite subjective. Even the data available in previous research articles can be limited to subjective inference, as the majority of the included studies were observational. Different kinds of methodologies and designs are followed by different studies, which are used to interpret periodontal and neurodegenerative diseases. This is the reason why it becomes difficult to compare the results of various studies. A few more factors that influence the outcomes of the study are age, smoking, and the presence of systemic diseases. [11] Future challenges may include limitation of knowledge and restricted training among the dental professionals, which is required for proper implementation of the data as a part of preventive healthcare.

FUTURE DIRECTIONS

The current literature leaves behind scope for future research as well. The future research work should focus on longitudinal cohort studies assessing temporal relationships. Randomized controlled trials can be conducted to further evaluate the effects of periodontal therapies in preventive healthcare outcomes. The development of interdisciplinary preventive healthcare is crucial to integrate this information into practical use. Preventive strategies of oral healthcare should be taken into consideration to manage and prevent cognitive outcomes of neurodegenerative diseases.

CONCLUSION

This review is in favor of the strong association between oral inflammatory diseases and neurodegenerative conditions. It gives a simple emphasis on the critical role of periodontal health in systemic well-being as well as neurological well-being. The progression of cognitive decline in neurodegenerative disorders is related to certain risk factors like chronic periodontal inflammation, oral dysbiosis, and the presence of pathogens like *Porphyromonas gingivalis. [12] The information provided in this systemic literature review can be used by dental professionals. If incorporated well, it may help in early diagnosis, preventive care, and long-term maintenance of geriatric patients. Oral healthcare professions may incorporate this information into their routine practices to contribute to improved health outcomes.*

ABBREVIATIONS:

1. IL-6 – Interleukin-6
2. TNF-α – Tumor necrosis factor

REFERENCES

1. Harding, A., Gonder, U., Robinson, S. J., Crean, S., & Singhrao, S. K. (2017). Exploring the association between Alzheimer's disease, oral health, microbial endocrinology and nutrition. *Frontiers in Aging Neuroscience, 9*, 398.
2. Holmer, J., Eriksdotter, M., Schultzberg, M., Pussinen, P. J., & Buhlin, K. (2018). Association between periodontitis and risk of Alzheimer's disease, mild cognitive impairment, and subjective cognitive decline: A case–control study. *Journal of Clinical Periodontology, 45*(11), 1287–1298.
3. Ide, M., Harris, M., Stevens, A., Sussams, R., Hopkins, V., Culliford, D., … Holmes, C. (2016). Periodontitis and cognitive decline in Alzheimer's disease. *PLoS ONE, 11*(3), e0151081.
4. Kamer, A. R., Craig, R. G., Pirraglia, E., Dasanayake, A. P., & Norman, R. G. (2009). Periodontal disease as a possible risk factor for Alzheimer's disease. *Archives of Neurology, 65*(11), 1406–1413.
5. Kamer, A. R., Morse, D. E., Holm-Pedersen, P., Mortensen, E. L., & Avlund, K. (2012). Periodontal inflammation in relation to cognitive function in an older adult Danish population. *Journal of Alzheimer's Disease, 28*(3), 613–624.
6. Leira, Y., Domínguez, C., Seoane, J., Seoane-Romero, J., Pías-Peleteiro, J. M., Takkouche, B., & Blanco, J. (2017). Is periodontal disease associated with Alzheimer's disease? A systematic review with meta-analysis. *Neuroepidemiology, 48*(1–2), 21–31.
7. Noble, J. M., Scarmeas, N., Celenti, R. S., Elkind, M. S. V., Wright, C. B., Schupf, N., & Papapanou, P. N. (2014). Serum IgG antibody levels to periodontal microbiota are associated with risk for Alzheimer's disease. *PLoS ONE, 9*(12), e114959.

8. Poole, S., Singhrao, S. K., Kesavalu, L., Curtis, M. A., & Crean, S. (2013). Determining the presence of periodontopathic virulence factors in short-term postmortem Alzheimer's disease brain tissue. *Journal of Alzheimer's Disease, 36*(4), 665–677.
9. Singhrao, S. K., Olsen, I., Poole, S., & Kesavalu, L. (2015). The role of *Porphyromonas gingivalis* in periodontal disease and possible links with Alzheimer's disease. *Periodontology 2000, 69*(1), 196–222.
10. Soiniemi, L., Solje, E., Suominen, A. L., Kanninen, K. M., & Kullaa, A. M. (2024). The association between oral diseases and neurodegenerative disorders. *Journal of Alzheimer's Disease, 102*(3), 577–586.
11. Stein, P. S., Steffen, M. J., Smith, C., Jicha, G., Ebersole, J. L., & Abner, E. (2012). Serum antibodies to periodontal pathogens are a risk factor for Alzheimer's disease. *Alzheimer's & Dementia, 8*(3), 196–203.
12. Tonetti, M. S., Van Dyke, T. E., & Working Group 1 of the Joint EFP/AAP Workshop. (2013). Periodontitis and atherosclerotic cardiovascular disease: Consensus report. *Journal of Periodontology*, *84*(4 Suppl), S24–S29.