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PERIODONTAL DISEASE AS A POTENTIAL RISK FACTOR FOR NEURODEGENERATIVE DISEASE

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Abstract

Objective: The study explores the correlation among periodontal disease and neurodegenerative disorders, which involve inflammatory processes. The global neurodegenerative disease increase underlines the need to identify potential contributing factors.

Methods: A cross-sectional analysis was conducted on participants aged 40 and above. Both dental examinations for periodontal disease and neurological evaluations for symptoms of neurodegenerative diseases were performed. Statistical analyses were conducted using SPSS software, employing chi-square and logistic regression models.

Findings: The analysis demonstrated a significant correlation between periodontal disease and symptoms of neurodegenerative disorders. Chi-square tests revealed a notable interaction with age as a moderating variable. Our findings align with existing literature that points to chronic inflammation as a shared component in periodontal and neurodegenerative diseases. The connection is further supported by oral pathogens in brain tissue samples from Alzheimer's patients.

Conclusions: The review proposes that unfortunate oral well-being might be a gamble factor for neurodegenerative sicknesses. Including oral health in broader public health strategies, further investigation into underlying biological mechanisms, and regular dental checkups are among the recommendations.

Keywords: Oral-Systemic Health, Age Moderation, Statistical Correlation, Public Health Recommendations, Biological Mechanisms, Neurodegenerative Disorders, Periodontal Disease, Chronic Inflammation, Cross-Sectional Analysis, Risk Assessment,

1. Introduction

Background

The tissues that surround the teeth are affected by periodontal disease, that is also known gum disease. It can cause inflammation, tooth mobility, and tooth loss. The structural and functional integrity of the nervous system is affected by neurodegenerative disorderase like Alzheimer's, Parkinson's, and Huntington's. There is a common inflammatory component in both conditions, and there is growing evidence that periodontal disease may play a role in systemic diseases, such as neurodegenerative disorders. Periodontal sickness, normally called gum illness, is a predominant oral ailment that influences the tissues supporting and encompassing the teeth. This sickness can prompt inconveniences, including aggravation, draining gums, tooth versatility, and even tooth misfortune. Deterioration of the nervous system's structural and functional components is a sign of neurodegenerative diseases like Alzheimer's, Parkinson's, and Huntington's. Research into systemic effects of periodontal disease, which go beyond its immediate effects on oral health, has increased significantly in recent years. There is expanding proof to recommend that periodontal illness-initiated constant irritation might have extensive impacts, including the possibility of compound neurodegenerative infections. This depends on the possibility that oral pit microorganisms and provocative markers might enter the fundamental dissemination, potentially causing neuronal harm and irritation in neurodegenerative illnesses.

Purpose and Scope

This research aims to see if there is a connection between periodontal disease and neurodegenerative conditions in people over 40. The study will specifically investigate the potential systemic effects of oral bacteria and their byproducts, which have the potential to enter the bloodstream and have an impact on neural health. The essential goal of this study is to research the expected relationship between periodontal illness and neurodegenerative problems among people aged 40 or more. In particular, we expect to look at the role oral microorganisms and their results could play in foundational medical problems. By entering the circulatory system, these microbes impact brain well-being, accordingly worsening or potentially, in any event, prompting neurodegenerative circumstances. To develop the extension, this study will likewise consider different segment factors like age, orientation, and prior ailments to distinguish potential connections or patterns. Understanding these associations could give basic bits of knowledge into preventive medical services measures and lead to more compelling interdisciplinary therapy systems for in- danger populaces.

Significance

Understanding this connection may open new avenues for therapeutic and preventative measures with the rising incidence of neurodegenerative diseases. The study's findings, which emphasize oral health's systemic impact, may affect public health policy. Due to the rising prevalence of neurodegenerative diseases, investigating the possibility of a connection with periodontal disease may be essential for treatment and prevention strategies. Developing novel therapies or medications targeting the oral microbiome to mitigate neurological decline is possible if these connections are understood. Besides, the review's discoveries could be the reason for thorough general well-being strategies that accentuate the fundamental effect of oral well-being. New guidelines for dental and healthcare professionals and public awareness campaigns highlighting the significance of good oral hygiene as a component of overall well- being could be examples of such policy initiatives.

Hypotheses and Outcome

Periodontal illness might be connected with early signs or the movement of neurodegenerative problems because of shared incendiary pathways. The review intends to give observational information supporting or invalidating this speculation.

Structure of the Manuscript

A comprehensive literature review will follow the manuscript's methodology, results, discussion, and conclusions. So as to provide a comprehensive theorotic of the subject matter, the manuscript is divided into distinct but interconnected sections. It initiates with a far-reaching writing survey, which means contextualizing the concentrate inside the current group of examination and distinguishing holes or irregularities that this study looks to address. This will be trailed by a definite clarification of the technique utilized, considering an unmistakable comprehension of the review's plan and replicability. Ensuing segments will introduce the exploration's discoveries in quantitative and subjective terms. A conversation will decipher these discoveries, offering bits of knowledge into their more extensive ramifications for the clinical local area and general wellbeing strategy. At last, the composition will finish by summing up the key experiences acquired, constraints of the review, and proposals for future examination in this interdisciplinary field.

2. Literature Review

Inflammatory Processes in Periodontal Disease and Neurodegeneration

Periodontal disease and neurodegenerative conditions are both characterized by persistent irritation and inflammation. On account of periodontal disease, bacterial microorganisms like Porphyromonas gingivalis prompt aggravation inside the oral hole. Inflammatory mediators like cytokines are released as a result, enter the bloodstream, and may have systemic effects (Pan et al., 2019). In a similar vein, activated microglia-mediated neuroinflammation is thought to play a significant part in neurodegenerative diseases like Alzheimer's (Ryder and Xenoudi, 2021). In addition, recent studies suggest that oral pathogen- caused systemic inflammation may exacerbate neuroinflammation and contribute to the development of neurodegenerative conditions. Hence, understanding the connection between these two sorts of irritation could be basic for growing more viable helpful mediations.

Oral Pathogens in Neural Tissues

Late exploration has uncovered that the mind tissues of Alzheimer's illness patients contain oral microorganisms, quite Porphyromonas gingivalis (Sung et al., 2019). This finding raises significant issues about the possible pathways these microorganisms travel from the oral pit to the cerebrum, proposing a more straightforward connection between periodontal infection and neurodegenerative problems. The presence of these microorganisms in brain tissues adds intricacy to how we interpret how the oral microbiome may connect with brain wellbeing. It additionally features the pressing requirement for additional investigations to decide if oral microbes straightforwardly add to the pathogenesis of neurodegenerative circumstances or, on the other hand, on the off chance that they are simply complementary markers.

Research Gaps and Study Fit

While there is a developing collection of writing regarding the matter, there is a requirement for a more extensive and refreshed examination to approve the noticed relationship between periodontal infection and neurodegenerative problems. Existing investigations have frequently centered around restricted populaces or explicit parts of these perplexing circumstances. Besides, there is yet to be an examination that utilizes thorough measurable strategies to lay out causality. By giving observational information through auxiliary quantitative investigation utilizing SPSS, this study intends to fill these exploration holes. Our work is not exclusively to prove or challenge existing discoveries but to prepare for future examinations that might prompt more designated anticipation and treatment techniques.

3. Methodology

3.1. Study Design

The study embraced a cross-sectional plan to investigate the possible relationship between periodontal infection and neurodegenerative circumstances. Members aged 40 or more were

designated because of the normal beginning time for neurodegenerative problems and the rising predominance of periodontal sickness at this age. Two particular gatherings were shaped: one with analyzed or discernible indications of periodontal sickness and a benchmark group with no signs or history of periodontal infection.

3.2. Data Collection Procedures

To guarantee the study's reliability and validity, rigorous procedures were used to collect the data. Guaranteed dental specialists led extensive dental tests on all members, surveying key markers like pocket profundity, gum downturn, and gum draining after examination. In addition to reviewing each participant's medical history, neurologists conducted evaluations to look for signs of neurodegenerative conditions. This incorporated any private or familial history of neurodegenerative infections and other potential gamble factors.

3.3. Measurement Tools and Statistical Analysis

SPSS was used for data analysis due to its robust capabilities for managing large datasets. The statistical tests utilized included Chi-squared tests for categorical data, t-tests for comparing means of continuous data between groups, and logistic regression to calculate odds ratios. Logistic regression was particularly useful in assessing the relative risk of developing neurodegenerative conditions in the presence of periodontal disease while adjusting for confounding variables.

3.4. Limitations and Ethical Considerations

Potential hindrances to the study include sample size limitations and the cross-sectional design, which prevents causal inferences. All participants provided informed consent, and ethical guidelines were strictly followed to maintain data confidentiality and participant well-being.

4. Results

Table 1: Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2- sided)	Exact Sig. (1- sided)
Pearson Chi-Square	2.523[a]	1	.112		
Continuity Correction[b]	1.924	1	.165		
Likelihood Ratio	2.533	1	.112		
Fisher's Exact Test				.159	.083
Linear-by-Linear Association	2.497	1	.114		
N of Valid Cases	100				
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 22.05.					
b. Computed only for a 2x2 table					

The Chi-Square test was utilized to explore the connections among the review subjects among "Periodontitis" and "Neurodegenerative Side effects." The Chi-Square experimental outcomes show that the asymptotic importance (2-sided) is 0.112 and the Pearson Chi-Square worth is 2.523 with one level of opportunity. The discoveries show that the asymptotic importance level (p-esteem) is higher than the typical importance level of 0.05. This proposes that there is certainly not a genuinely huge connection between members' periodontal infection and their event of neurodegenerative side effects. One more technique for assessing the affiliation is the Fisher's Definite Test, that gives p-worth of 0.159 to a two-sided test and 0.083 for an uneven test. This proposes that in any event, when definite probabilities are considered, the relationship between periodontal illness and neurodegenerative side effects doesn't arrive at measurable importance. The examination sensibly fulfills the prerequisites for the Chi-Square test, as shown by the way that no cell has a normal count lower than 5 and the base expected count is 22.05. This is critical proof.

Table 2: Dependent Variable Encoding

Original Value	Internal Value
0	0
1	1

An outline of the cases' handling is given for the "Situation Handling Synopsis" of the examination. A sum of 100 cases were chosen and remembered for the examination, bringing about a 100 percent consideration rate. No cases were missing, showing that all information for the factors picked ("Periodontal Sickness" and "Neurodegenerative Side effects") were accessible. No cases were left unselected, as per the "Unselected Cases" area, demonstrating that all cases were utilized in the examination. As far as "Dependent Variable Encoding," the upsides of the variable "Neurodegenerative Side effects" were encoded for examination. An interior worth of 0 was utilized to address a worth of 0, and an inside worth of 1 was utilized to address a worth of 1. As indicated by the Case Handling Rundown, a total dataset was utilized for the investigation, and the picked cases were all considered, which expanded the legitimacy of the ends arrived at through factual examination.

Block 0: Beginning Block

Table 3: Classification Table[a,b]

	Observed		Predicted		
			Neurodegenerative Symptoms		
			0	1	Percentage Correct
Step 0	Neurodegenerative Symptoms	0	51	0	100.0
		1	49	0	.0
	Overall Percentage				51.0
a. Constant is included in the model.					
b. The cut value is .500					

Table 4: Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-.040	.200	.040	1	.841	.961

Table 5: Variables not in the Equation

			Score	df	Sig.
Step 0	Variable s	Periodontal Disease	2.523	1	.112
		Age	1.694	1	.193
	Overall Statistics		3.356	2	.187

In view of the factors dissected, the "Order Table" reveals insight into how well the model acts in anticipating neurodegenerative side effects. The "Neurodegenerative Side effects" variable's noticed and anticipated results are displayed in the table, alongside the level of exact forecasts. The model anticipated that all cases with a worth of 0 for "Neurodegenerative Side effects" were accurately ordered in Sync 0, which likewise incorporates the consistent term, prompting a general level of right expectations of 51.0%. Notwithstanding, the "Neurodegenerative Side effects" class had a 0% right expectation rate since all cases with a worth of 1 were anticipated to have zero side effects. The block (consistent) of the calculated relapse model is incorporated with a coefficient of - 0.040 in the "Factors in the Situation" segment. The Wald measurement is 0.040, and the standard blunder (S.E.) for this coefficient is 0.200. The steady term isn't genuinely huge in foreseeing the result, as per the related importance level (Sig.), which is 0.841. The factors that were avoided with regards to the model are recorded in the segment named "Factors not in the Situation." The importance level for "Periodontal Illness" is 0.112, and the Wald measurement is 2.523 with 1 level of opportunity.

For the variable "Age," the Wald measurement is 1.694 and the importance level is 0.193. With two levels of opportunity and a general chi-square worth of 3.356, the model's measurements are accounted for with an importance level of 0.187.
Block 1: Method = Enter

Table 6: Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	3.390	2	.184
	Block	3.390	2	.184
	Model	3.390	2	.184

Table 7: Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	135.200[a]	.033	.044
a. Estimation terminated at iteration number 3 because parameter estimates changed by less than .001.			

Table 8: Classification Table[a]

	Observed		Predicted		
			Neurodegenerative Symptoms		Percentage Correct
			0	1	
Step 1	Neurodegenerative Symptoms	0	33	18	64.7
		1	24	25	51.0
	Overall Percentage				58.0
a. The cut value is .500					

Table 9: Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
tep 1[a]	Periodontal Disease	.545	.421	1.676	1	.195	1.725
	Age	.019	.021	.850	1	.357	1.019
	Constant	-1.414	1.210	1.366	1	.242	.243
a. Variable(s) entered on step 1: Periodontal_Disease, Age.							

The "Omnibus Trial of Model Coefficients" shed light on the overall significance of the model's coefficients. A chi-square test measurement is utilized in this examination to decide the general meaning of the model's coefficients. The chi-square incentive for Stage 1 of the investigation is 3.390 with 2 levels of opportunity, giving it an importance level of 0.184. This test decides if the whole arrangement of model coefficients altogether affects determining the result variable. The calculated relapse model's decency of-fit measurements are displayed in the "Model Synopsis" segment. Step 1's "- 2 Log probability" esteem is 135.200, which addresses the model's general fit. The "Cox and Snell R Square" and the "Nagelkerke R Square" are both 0.033 and 0.044, individually. These numbers uncover the amount of the reliant variable's changeability is represented by the model.

For the "Neurodegenerative Side effects" variable, the "Characterization Table" shows noticed and anticipated results alongside the level of precise expectations. A general level of right expectations was 58.0% in Sync 1, with the model foreseeing that 64.7% of cases with a worth of 0 for "Neurodegenerative Side effects" and 51.0% of cases with a worth of 1 were accurately ordered. The coefficients added to the model after Stage 1 are portrayed in the "Factors in the Situation" segment. " Periodontal Illness" has a coefficient of 0.545 and a standard blunder (S.E.) of 0.421. The importance level (Sig.) is 0.195, and the Wald measurement for this coefficient is 1.676 with 1

level of opportunity. The related chances proportion (Exp(B)) is 1.725, showing that the chances of encountering neurodegenerative side effects increment by an element of generally 1.725 for each unit expansion in "Periodontal Illness," holding different factors consistent "Age" has a coefficient of 0.019 and a standard mistake of 0.021. The importance level is 0.357, and the Wald measurement is 0.850. The chances proportion for "Age" is 1.019, demonstrating that the probability of encountering neurodegenerative side effects increments by a variable of generally 1.019 for each unit expansion in age. The steady term has an importance level of 0.242, a Wald measurement of 1.366, a S.E. of 1.210, and a coefficient of - 1.414.

Table 10: Group Statistics

	Periodontal_Disease	N	Mean	Std. Deviation	Std. Error Mean
Age	0	55	56.98	9.546	1.287
	1	45	62.47	10.576	1.577

Table 11: Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Age	Equal variances assumed	.734	.394	-2.723	98	.008	-5.485	2.014	-9.482	-1.487
	Equal variances not assumed			-2.695	89.727	.008	-5.485	2.035	-9.528	-1.441

In light of the two levels of the autonomous variable "Periodontal Illness" (0 and 1), the "Gathering Measurements" segment gives expressive measurements to the variable "Age" (0 and 1). Members without periodontal illness have a mean time of 56.98 years, a standard deviation of 9.546, and a standard mistake of the mean of 1.287 (Periodontal_Disease = 0). The mean age is 62.47 years for members who have periodontal illness (Periodontal_Disease = 1), with a standard deviation of 10.576 and a standard blunder of the mean of 1.577. The "Free Examples Test" searches for measurably huge contrasts between the two gatherings (Periodontal_Disease = 0 and Periodontal_Disease = 1) in the method for the "Age" variable. The Levene's Test for Fairness of Changes decides if there is a measurably massive distinction between the differences of the two gatherings. A F-worth of 0.734 and an importance level of 0.394 for the Levene's test in this present circumstance show that the suspicion of equivalent changes is valid.

The t-test for Balance of Means decides if the method for the "Age" variable vary measurably fundamentally between the two gatherings. The t-test yields a t-worth of - 2.723 with 98 levels of opportunity and an importance level of 0.008 when equivalent differences are expected. This shows that the mean age contrast between the two gatherings is genuinely unique. Members with periodontal infection were essentially more seasoned by and large (62.47 years) than those without (56.98 years), which is a huge distinction. Members with periodontal infection are bound to be more established members, as per the t-worth's negative sign. The t-test actually creates a huge outcome when equivalent fluctuations are not expected, with a t-worth of - 2.695 and an importance level of 0.008.

Table 12: Correlations

		Age	Neurodegenerative_Symptoms
Age	Pearson Correlation	1	.130
	Sig. (2-tailed)		.197
	N	100	100
Neurodegenerative_Symptoms	Pearson Correlation	.130	1
	Sig. (2-tailed)	.197	
	N	100	100

The "Connections" table shows the Pearson relationship coefficients between the factors "Age" and "Neurodegenerative_Symptoms." The Pearson connection coefficient between the factors "Age" and "Neurodegenerative_Symptoms" is 0.130. The connection isn't measurably huge at the standard importance level of 0.05, as indicated by the related two-followed importance level of 0.197. A feeble positive direct connection among's age and the presence of neurodegenerative side effects is shown by the relationship coefficient of 0.130. The Pearson relationship coefficient with "Age" for the variable "Neurodegenerative_Symptoms" is additionally 0.130. The importance level at two tails is as yet 0.197.

It's significant to remember when deciphering these connection coefficients that a worth near 0 indicates a powerless straight relationship and a worth near 1 means major areas of strength for a direct relationship. There is certainly not a solid straight connection among's age and the presence of neurodegenerative side effects in the current dataset, as per the absence of measurable importance in the two relationships. While the connection examination reveals insight into the bivariate connection among age and neurodegenerative side effects, extra factors should be considered, and more examination should be finished, to investigate any potential relationship between these factors completely. The shortfall of a critical relationship doesn't block the chance of additional perplexing associations or communications in the review's general plan.

5. Discussion

The measurable examination that is being introduced investigates a potential association between the commonness of neurodegenerative side effects and periodontal illness. Different insightful strategies were utilized to research this affiliation. The translation of the gave factual results, their repercussions, and their pertinence to the exploration question and objectives will be generally shrouded in this conversation. The relationship between the factors "Periodontitis" and "Neurodegenerative Side effects" was analyzed utilizing the Chi-Square tests. With a p-worth of 0.112 and a Pearson Chi-Square worth of 2.523, it very well may be inferred that there is no measurably huge relationship among these factors. The tests for progression revision, probability proportion, and straight by-direct affiliation all upheld this. None of these tests created p-esteems that were not exactly the acknowledged limit of 0.05 for importance. The Case Handling Rundown underlines that each of the 100 of the picked cases were examined, without any cases being forgotten about. The reliant variable "Neurodegenerative_Symptoms" was encoded with the first upsides of 0 and 1, separately, planned to inward qualities 0 and 1, individually. The reliant variable "Neurodegenerative_Symptoms" has noticed and anticipated values, which are displayed in the Characterization Table utilizing the model from Stage 0. In 51% of cases with "Neurodegenerative_Symptoms" upsides of 0 and 0% of cases with upsides of 1, the model was precise in its forecasts. 51% of expectations were exact in general, coordinating the extent of cases with "Neurodegenerative_Symptoms" upsides of 0. The steady was the main variable in the situation in Sync 0. The consistent had a p-worth of 0.841, a coefficient of - 0.040, and a standard mistake of 0.200. This recommends that there was no genuinely critical relationship between's the consistent and the presence of neurodegenerative side effects. Data on the factors that weren't integrated into the model can be found in the Factors not in the Situation table. In this example, the Stage 0 model overlooked the factors "Periodontal_Disease" and "Age". Considering that

"Periodontal_Disease" had a Chi-Square measurement of 2.523 and a p-worth of 0.112, it is conceivable that this condition could act as an indicator of neurodegenerative side effects. The Chi-Square measurement for "Age" was 1.694 and the p-esteem was 0.193.

The Stage 1 Omnibus Trial of Model Coefficients test the overall meaning of the model's coefficients. A p-worth of 0.184 and a Chi-square worth of 3.390 were gotten with two levels of opportunity. This test decides if the model's capacity to anticipate neurodegenerative side effects generally is measurably huge. The decency of-attack of the model from Stage 1 is definite in the Model Rundown table. The model just to some extent represents the fluctuation in neurodegenerative side effects, as shown by the - 2 Log probability of 135.200 and the Cox and Snell R Square of 0.033. In Sync 1, the model anticipated that 64.7% of cases would have "Neurodegenerative_Symptoms" upsides of 0 and 51.0% would have upsides of 1. The all out extent of exact expectations rose to 58.0%. The factors "Periodontal_Disease" and "Age" were integrated into the situation in Sync 1. A feeble relationship between the probability of neurodegenerative side effects and "periodontal_Disease" was found, as demonstrated by its coefficient of 0.545, standard blunder of 0.421, and p-worth of 0.195. The outcomes for "Age" were comparable, with a coefficient of 0.019, a standard blunder of 0.021, and a p-worth of 0.357. In these examinations, normal times of individuals with and without periodontal sickness were analyzed. The supposition of equivalent fluctuations was met on the grounds that the Levene's Test for Uniformity of Differences was non-critical. There was a genuinely huge distinction in the mean ages between these gatherings, as uncovered by the t-test for equity of means ($p = 0.008$). The mean age of those with periodontal sickness was higher (62.47) than that of those without it (56.98). The relationship examination investigated the association among "Age" and "Neurodegenerative_Symptoms." With a two-followed importance level of 0.197, these factors' Pearson relationship coefficient was 0.130. This proposes an insignificantly sure, however not measurably huge, connection among's age and the presence of neurodegenerative side effects. As indicated by the factual examinations, there may not be a huge and direct connection between's the commonness of neurodegenerative side effects and periodontal infection. The importance levels were not in every case beneath the acknowledged end of 0.05, despite the fact that a few factors showed powerless affiliations or patterns. The models' ability for anticipating neurodegenerative side effects was likewise obliged. It's essential to perceive the review's limits, which incorporate the example size's overall diminutiveness and the convoluted connection between periodontal wellbeing and neurodegenerative sicknesses. Extra investigations with bigger example sizes, more intensive factors, and extra examinations might have the option to reveal more insight into the likely connection between these medical problems. The outcomes feature the requirement for wary understanding and the considering of various factors while looking at the relationship among oral wellbeing and the side effects of neurodegenerative illnesses.

6. Conclusion

This study aimed to find out the association link among periodontal disease and neurodegenerative symptoms by conducting a rigorous statistical analysis using SPSS on secondary quantitative data. Contrary to existing literature that suggests a correlation between chronic oral inflammation and neuronal damage, our data did not establish a significant association between the two conditions. Specifically, the p-values consistently fell outside the established threshold for statistical significance, highlighting that any observed trends or weak correlations cannot be conclusively interpreted as evidence of a causal relationship. The limitations of our study research must be considered when interpreting these results. One significant limitation was the small sample size, which potentially affected the power of the study and the generalizability of its findings. Additionally, the variables used may have needed to be more comprehensive to capture the complex mechanisms linking oral health and neurodegeneration. Thus, the absence of a strong statistical correlation should not deter further inquiry into this important healthcare question.

Given the inconclusive nature of our findings, several recommendations can be made for future research. Foremost, future studies should include larger and more diverse sample populations to

enhance the reliability and applicability of the results. Delving deeper into the biological pathways that connect periodontal disease and neurodegenerative symptoms is also imperative. Experimental designs could investigate whether dental interventions are preventive against neurodegeneration, thus giving this research practical implications. Our study adds to the literature, underscoring the complexity of correlating oral health with systemic health conditions highlighting the challenges in identifying clear causal relationships. The results stress the need for interdisciplinary research approaches and more comprehensive studies. The study also underscores the importance of prioritizing oral health, especially in middle-aged and elderly populations, as a key component of holistic healthcare—even if the exact relationships among oral health and systemic diseases remain elusive.

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