

Parkinson's Disease and Periodontal Health

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Abstract

Introduction: Parkinson's Disease is the second most common neurodegenerative disorder which occurs mainly due to the deficiency or loss of dopaminergic neurons in the midbrain. It is a chronic and debilitating disease that affects motor functions followed by cognitive impairment and has been shown to have significantly increased in prevalence over the past three decades. Periodontitis is a more severe form of periodontal disease that results from the infection and inflammation of gums and bone that surround and support the teeth.

Aim: The purpose of this review was to investigate the relationship between Parkinson's Disease and the periodontal health of the patients suffering from the neurodegenerative disorder (Parkinson's Disease).

Materials And Methods: The search strategy for this review was performed in PubMed and Google Scholar databases. The review included the articles from the year 1992 to 2021 and comprised of 1540 participants. The studies included certain parameters such as PPD, CAL,

API, BOP, PI and tooth mobility based on which conclusions were drawn whether Parkinson's Disease has any association with periodontal health in patients already having PD.

Conclusion: From the eight studies included in this review, most of these studies reported an association between Parkinson's Disease and periodontal health of the participants in this review. All of these included studies presented a low risk of bias. Despite the fact that every study that was included in this review indicated a correlation between periodontal health and Parkinson's disease, the level of evidence was rated as extremely low, indicating that the findings should be interpreted with caution.

Keywords: Parkinson's Disease, CNS, PPD, CAL.

Introduction

Neurodegenerative condition is a broad expression for a group of disorders that damage the central nervous system (CNS), characterized by the progressive loss of neuronal structure and function. These diseases are incurable and lead to a progressive decline or even the

complete loss of sensory, motor, and cognitive functions [1]. According to the World Health Organization, neurodegenerative conditions affect up to 1 billion people worldwide and the proportion is growing with the aging of the world population; they lead to the death of about 6.8 million people per year, equivalent to 12% of all deaths in the world [2]. Among the different types of neurodegenerative diseases, Alzheimer's disease (AD), Huntington's disease, Parkinson's disease (PD), and multiple sclerosis are the most frequently occurring [1].

Parkinson's Disease (PD) is the second most common, age-related neurodegenerative disorder, affecting about 3% of the population by the age of 65 and up to 5% of the people over 85 years [3]. Parkinson's Disease was first medically described as a neurological syndrome by James Parkinson in 1817, though fragments of Parkinsonism can be found in earlier descriptions [4]. The main pathological feature of PD is the progressive loss of midbrain dopaminergic (DA) neurons in the substantia nigra pars compacta (SNc) and the presence of alpha-synuclein positive cytoplasmic inclusions, termed Lewy bodies, in surviving neurons [5]. Although PD is best known for affecting a patient's motor system – causing tremors, akinesia, and postural instability – it is associated debilitating nonmotor symptoms that often have the most negative impact on quality of life. These include behavioural, cognitive, cardiac, autonomic, sleep, sexual, and sensorimotor dysfunctions; gastric and intestinal problems; urinary incontinence; constipation; and dysphagia [6]. Dementia is one of the common complications found in the patients with Parkinson's Disease. Some of the risk factors for PD include age, sex, heredity and exposure to toxins such as pesticides, air pollution and industrial pollutants. PD affects men twice more often than women [7,8], but women have a

higher mortality rate and faster progression of the disease [9]. Moreover, women show distinctive symptoms as well as differences in the response to pharmacological therapies and deep brain stimulation procedure, and in the personal evaluation of the quality of life compared with men [10]. In 2005, researchers discovered a single mutation in a Parkinson's disease gene (first identified in 1997), which is believed to be responsible for 5% of inherited cases.

Deaths occur at a much faster rate in patients suffering from PD rather than any other neurological disorders. According to WHO, the prevalence of PD has doubled in the last 25 years. As per an estimate made in the year 2019, approximately 8.5 million people suffered from PD throughout the world. Current estimates suggest an 81% increase in disability-adjusted life years of approximately 5.8 million since 2000, and nearly 100% increase of 329,000 deaths since 2000.

Periodontitis is considered to be the sixth most prevalent disease in the world and has a great impact on oral health, including tooth loss and edentulism [11,12], which negatively affect the quality of life of patients [13]. There has been an association between the neurological conditions and periodontal health of the patients. Systemic conditions can negatively affect oral health [14]. Dental disease and Parkinson's disease have been linked to problems in oral health due to poor exercise and cognitive control among patients with Parkinson's disease [15]. Conditions that may result due to poor oral hygiene include periodontitis, impairment of taste, higher prevalence of dental caries, sialorrhea and xerostomia. Patients with Parkinson's Disease have significantly more cariogenic bacteria in their saliva [16]. Also, there is a decrease in frequency of toothbrushing and reduced salivary flow. Furthermore, occurrence of dental caries and tooth loss is higher in

patients with PD rather than the control group. Significant differences were also seen in probing depth, clinical attachment loss (CAL), gingival index and plaque index.

This study is done to assess the relationship between periodontitis and Parkinson’s Disease with the help of certain parameters such as probing depth, CAL, gingival index, plaque index, tooth loss, bleeding on probing.

Study Design

A cross-sectional observational study design was employed to investigate the potential correlation between Parkinson’s Disease (PD) and Periodontal Health.

Eligibility Criteria

Inclusion Criteria: The inclusion criteria were as follows:

- Study design: In-vivo studies – Observational studies or Clinical trials determining the association of Parkinson’s Disease and Periodontal Health.
- Participant Characteristics: Patients with and without PD
- Outcome measurements: Relationship between Parkinson’s Disease and periodontal health of patients determined using different factors irrespective of quantifying the outcomes.
- Articles written in English language.
- Articles available as free full text

Exclusion Criteria: The exclusion criteria were as follows:

Final Table

Sn.	Author (Year)	Country	Sample Size (N)	Mean Age (Years)	Outcome Assist	Parameters	Conclusion
1.	Einarsdóttir et al. (2009) [17]	Iceland	122 PD = 67 CG = 55	<60 to <70	To assess the levels of oral hygiene and	PPD, API, radiograph	PD patients had worse scores of API and PPD

- Non-clinical studies, in-vitro studies, and animal studies
- Studies done on individuals less than 18 years of age
- Studies not fully available in the database
- Articles reporting only abstracts were also excluded.
- Studies not reporting primary outcomes as well as primary outcomes that are not possible to calculate from the given raw data.

Search Strategy

Appropriate key words and Medical Subject Heading (MeSH) terms were selected and combined with Boolean operators like AND. The search strategy used was as follows: (Parkinson’s Disease AND periodontal health), (Parkinson’s Disease AND caries AND tooth loss AND clinical attachment loss AND periodontal health), (Parkinson’s Disease AND bleeding on probing AND gingival index AND plaque index AND probing depth AND periodontitis).

The articles were chosen in two stages. Two reviewers examined each article's title and abstract in phase one. The inclusion requirements which were not met by any of the articles, were excluded. Phase two involved the independent screening and reviews of a few full articles by the same reviewers. Discussion was used to settle any differences. When the two reviewers could not agree, a third reviewer was brought in to render the ultimate judgement. The final selection was based on consensus among all three authors.

					periodontal status of PD patients.		compared with controls.
2.	Hanaoka and Kashihara (2009) [18]	Japan	157 PD = 89 CG = 68	72.1	To evaluate the oral hygiene status in patients with Parkinson's Disease.	PPD	The frequency of deep periodontal pockets was higher for patients with PD.
3.	Müller et al. (2011) [19]	Germany	176 PD = 101 CG = 75	66.2	To evaluate the oral health of patients with PD and comparing them with control group.	PBI, PI, API, CAL, OHI	PD patients were found to have more severe clinical parameters of periodontitis.
4.	John et al. (2021) [20]	India	74 PD = 32 CG = 42	58.4	To investigate the influence of reduced motor proficiency on periodontal health of PD patients.	PPD	Deeper pockets present in PD patients.
5.	Schwarz et al. (2006) [21]	Germany	155 PD = 70 CG = 85	64.5	To examine whether the oral health care of PD patients is affected due to interference with hand movements.	PPD	More number pockets ($\geq 4\text{mm}$) or deeper pockets in PD patients compared to healthy individuals.
6.	Persson et al. (1992) [22]	Sweden	615 PD = 30	73	To assess the influence of	PPD	Significantly higher number of

			CG = 585		PD on oral health of patients.		pockets but did not statistically analyse the difference between the groups.
7.	van Stiphout et al. (2018) [23]	Netherlands	148 PD = 74 CG = 74	70.2	To examine the oral health status and compare it with the duration and severity of PD.	Tooth Mobility	PD patients showed significantly higher mobility.
8.	Ledwon et al. (2020) [24]	Austria	93 PD = 61 CG = 32	70.8	To examine the relationship between periodontal disease and motor impairment in the course of PD.	Tooth Mobility	No control group present. 100% tooth mobility present of which 20% showed severe tooth mobility

Study Characteristics

The above table provides an overview of the descriptive characteristics of the eight studies that were included. Data was evaluated from an aggregate of 1540 patients with mean age of 67.5 years. The articles were selected between 1992 and 2021 from 7 countries: one study [17] in Iceland, one study [18] in Japan, two studies [19, 21] in Germany, one study [20] in India, one study [22] in Sweden, one study [23] in Netherlands and one study [24] in Austria. The oral hygiene levels and periodontal status of PD patients was assessed in the studies [17, 18, 19, 23] of Iceland, Japan, Germany and Netherlands. The studies [20, 24] were conducted to examine the

effect of reduced motor efficiency and on periodontal health of patients with PD. The study [21] was done in Germany to investigate whether reduced hand movements interfere with the oral health care of PD patients.

Discussion

The evidence proving the link between periodontitis and neurodegenerative illnesses, particularly PD, was compiled in the current systematic review. Rigid criteria were followed in the selection of the studies to be included. All studies showed a low potential for bias and found a link between periodontitis and Parkinson’s Disease. There is still more research needed to determine

the relationship between periodontitis and the onset of Parkinson's disease. This study's goal was to evaluate the relationship between periodontitis and the likelihood of developing Parkinson's disease. A total of 1540 patients with the mean age of 67.5 years from eight studies were included in the article. The results of the study suggest that periodontitis is more prevalent in PD patients than controls on the basis of the clinical parameters.

Periodontitis is an inflammatory disease triggered by dysbiotic biofilms and the most severe form of periodontal disease [25]. It is diagnosed using clinical and radiographic evaluation of periodontal parameters, such as clinical attachment loss, probing depth, bleeding on probing, and/or radiographic bone loss [26, 27].

All of the studies that were considered for inclusion in this review evaluated the periodontal health of patients with PD using clinical or laboratory measures and individuals with Parkinson's disease had higher prevalence for periodontitis and the periodontal clinical parameters deteriorated with increase in the severity of Parkinson's disease [28].

Out of the eight included studies, two studies [17, 19] included several parameters such as API, PPD, PBI, CAL, OHI, PI as well as radiographic evaluation. Four studies [18, 20, 21, 22] included only PPD as clinical parameter. Remaining two studies [23, 24] included tooth mobility as sole parameter in assessing the periodontal health in PD patients out of which one study [24] did not include any control group and as a result one hundred percent tooth mobility was seen out of which severe tooth mobility accounted for twenty percent.

This study aimed to provide an insight of the possible association between Parkinson's Disease and periodontal health of patients and comparing the results with the control group. The review included several studies from

the year 1992 to 2021 and assessed the findings using different parameters such as bleeding on probing, probing pocket depth, clinical attachment loss, tooth mobility, plaque index and gingival index. From the findings of some studies, it can be observed that patients suffering from Parkinson's Disease showed more severe clinical parameters as compared to the controls. On the other hand, some studies failed to signify the difference between the two groups. Overall, it can be concluded that there is a probable association between PD and periodontal health of the patients suffering from PD.

A recent literature search was conducted till April 5, 2023 which evaluated the parameters associated to oral health in patients with PD. A total of 43 articles were included. Comparing PD patients to controls, it was discovered that there was a greater frequency of dental biofilm, bleeding/gingivitis, pocket depth (≥ 4 mm), tooth mobility, caries, and the quantity of decaying missing filled teeth/surfaces. Analysing edentulism and denture wear, however, did not reveal any differences between the two groups. The duration, intensity, and number of prescribed drugs for people with Parkinson's disease were all correlated with poor dental health. The study came to a conclusion that in comparison to healthy people, PD patients have poorer oral health. It is linked to the intensity and length of Parkinson's disease as well as drug use. As a result, routine consultations with dental health care providers are highly recommended, emphasizing prevention above all.

Limitations

The overall calibre of the included studies placed restrictions on this investigation. It is necessary to conduct more research on other standardized diagnostic tests with few possible sources of bias through careful planning, execution, and reporting.

Conclusion

This review concluded that the oral health was worse in patients suffering from PD as compared to the control group especially in terms of periodontal health and oral hygiene maintenance. All the included studies reported more severe clinical parameters of periodontitis. Although some minor issues were discovered in certain domains during the qualitative analysis, all of the studies were deemed to have low risk of bias and to contain valid and consistent information. More longitudinal studies are required to be carried out in order to assess the relationship between periodontal health and PD. At the moment, it can be concluded that there is an association between Parkinson's Disease and Periodontal Health.

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