

Original Article



Exploring the Impact of Oral and Dental Health on Quality of Life in Parkinson's Patients: A Comparative Study

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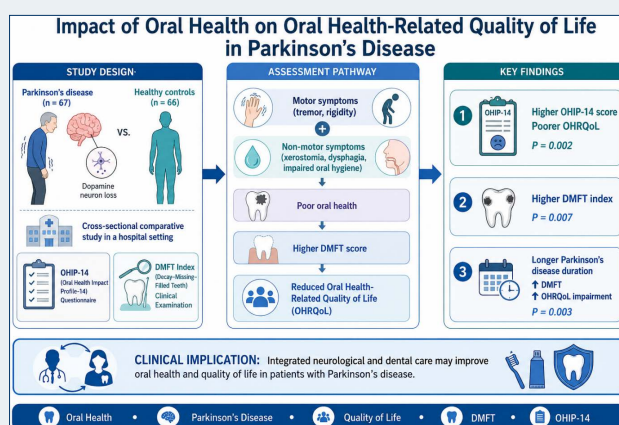
Abstract

Introduction: Parkinson's disease (PD) is characterized by symptoms such as tremors and rigidity, and non-motor symptoms including swallowing and speech difficulties. The non-motor problems can impair oral hygiene, leading to poorer dental health and reduced quality of life (QoL). This study aimed to compare oral health-related quality of life (OHRQoL) between patients with Parkinson's and healthy controls.

Methods: A descriptive-analytical study was conducted with 133 participants: 67 PD patients and 66 healthy controls. Data collection included the 14-item Oral Health Impact Profile (OHIP-14) questionnaire and an oral health behavior assessment. Clinical dental examinations recorded the number of decayed, missing, and filled teeth (DMFT) in PD patients. Statistical analyses such as one-way ANCOVA and linear regression controlled for confounders like age and education.

Results: Parkinson's patients showed significantly poorer OHRQoL than controls, with higher OHIP-14 scores (15.03 ± 9.42 vs. 10.3 ± 9.26 ; $P=0.002$), where higher scores indicate worse OHRQoL ($P<0.001$). The mean DMFT score was also higher in the PD group (3.25) compared to controls (2.66), with a significant difference ($P=0.007$). Additionally, a positive correlation between the disease duration and OHIP-14 scores indicated that the longer disease duration, the worse OHRQoL ($P=0.002$).

Conclusion: This study highlights the need for integrated medical and dental care for patients with Parkinson's disease. The relationship between disease progression and oral health significantly affects their overall quality of life.



Introduction

Parkinson's disease (PD) is a chronic and progressive neurodegenerative disorder characterized by the degeneration of dopaminergic neurons in the substantia nigra, a brain region responsible for coordinating movement.¹ This neuronal loss leads to hallmark motor symptoms of PD, including resting tremor, bradykinesia, rigidity, and postural instability. In addition to these motor symptoms, parkinson's patients often experience a

range of non-motor symptoms, such as cognitive decline, mood disorders, sleep disturbances, and autonomic dysfunction.² These non-motor symptoms significantly impact various aspects of daily life, including oral and dental health.³ Oral and dental health is a critical yet often overlooked aspect of overall well-being, particularly in individuals with PD.⁴ The motor and non-motor symptoms of PD contribute to various oral health challenges. Motor symptoms, including tremors and

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bradykinesia, can impair the ability to perform routine oral hygiene practices, resulting in poor dental care. Additionally, rigidity and reduced dexterity make it difficult for patients to use toothbrushes and dental floss effectively.⁵ Xerostomia, or dry mouth, is a common side effect of PD and the medications used to treat it which can increase the risk of dental caries, oral infections, and difficulties in chewing and swallowing.⁶ Furthermore, Parkinson's patients may also experience bruxism (teeth grinding) and orofacial pain, further complicating their dental health.⁷

Oral and dental health are integral components of Quality of life (QoL), a broad concept reflecting an individual's overall well-being and satisfaction across various domains, including physical health, psychological state, level of independence, social relationships, and personal beliefs.^{8,9} In PD, QoL is significantly affected by the interplay of motor and non-motor symptoms, which can affect nearly every aspect of a person's daily life.¹⁰ Poor oral health can cause pain, discomfort, and difficulties in eating, speaking, and social interaction, all of which can diminish QoL. In Parkinson's patients, these issues are often exacerbated by the disease's progression, leading to a greater need for comprehensive care strategies that address both neurological and dental health.¹¹

Recent studies have underscored the challenges PD patients face in maintaining oral health. Research by Verhoeff et al. (2022) demonstrated that individuals with PD exhibit a higher prevalence of dental caries, periodontal disease, and tooth loss compared to healthy individuals, primarily due to impaired motor control and reduced salivary flow.⁶ In Parkinson's patients, these issues are often exacerbated by the disease's progression, leading to a greater need for comprehensive care strategies that address both neurological and dental health.¹¹

Despite growing recognition of these issues, existing studies often rely solely on either self-reported questionnaires or clinical indices, without integrating both approaches.¹² Additionally, few investigations adequately adjust for critical confounding variables such as age, gender, and education level, which are known to influence oral health and QoL outcomes.¹³ Moreover, the specific association between disease duration and oral health remains insufficiently explored, despite emerging evidence suggesting a potential link.¹⁴

These gaps highlight the need for a comprehensive assessment that incorporates both subjective and objective measures—such as the Oral Health Impact Profile (OHIP-14) and the Decayed, Missing, and Filled Teeth (DMFT) index—while controlling for relevant demographic factors. Therefore, this study aimed to evaluate the impact of oral and dental health on the quality of life of individuals with Parkinson's disease compared with healthy individuals.

Methods

This descriptive-analytical study was conducted between

January to September 2024 at Imam Khomeini Hospital and private neurology clinics in Urmia. Participant recruitment took place from January to April 2024, while data collection was carried out between April and September 2024. A follow-up process was maintained throughout the study period to assess participants' oral health and QoL.

The control group consisted of 66 healthy individuals matched to PD patients based on age and gender. Participants were selected using simple random sampling through a random number table. The sample size of 66 per group was determined using the following formula, based on the mean and standard deviation of oral health-related QoL scores reported by Verhoeff et al. (2021) (PD: 19.1 ± 6.7 ; Controls: 16.5 ± 4.4).¹⁴

$$n = \frac{(z_{1-\alpha/2} + z_{1-\beta})^2 \times \delta_1^2 + \delta_2^2}{(\mu_1 - \mu_2)^2}$$

Exclusion criteria for both groups were the presence of systemic diseases, smoking, alcohol consumption, and major medical or psychiatric disorders. Healthy controls were recruited from the general population and underwent the same oral assessments as PD patients to ensure consistency in data collection.

To control for potential confounders, a one-way analysis of covariance (ANCOVA) was applied to compare the DMFT index and OHRQoL between groups, age and education level were included as covariates. Additionally, linear regression analysis was performed to assess the effects of age, gender, and disease duration on OHRQoL scores. These statistical methods minimized the influence of demographic and socioeconomic biases on the results.

The OHIP-14 questionnaire included 14 questions across seven domains (2 questions per domain) to assess oral health-related QoL in terms of functional limitations, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. It utilized an additive scoring method (ADD), where responses ranged from "never = 0" to "very often = 4", yielding total scores between 0 and 56. Lower scores indicate better oral health-related QoL. Using a 5-point scoring system, a score of 2 serves as the midpoint (cut-off point).¹⁴

The validity and reliability of the OHIP-14 questionnaire have been previously confirmed in several studies.^{15,16} To assess its validity, the questionnaire was emailed to three experts in dentistry, who validated its structural and content relevance for evaluating OHRQoL in Parkinson's patients. All experts validated its structural and content validity for assessing OHRQoL in Parkinson's patients. For reliability assessment, the questionnaire was distributed to 15 clinically diagnosed Parkinson's patients at two different time points (hospital and clinic settings). The collected responses showed a high correlation ($r = 0.8$) and a Cronbach's alpha coefficient of 0.78, indicating acceptable reliability and consistency. Additionally, the

objective assessment included oral characteristics such as the decayed, DMFT index, (, which was recorded by a dental student for all study participants.

After explaining the study's objectives, the researcher obtained written informed consent from participants or their representatives (for illiterate participants) at private neurology clinics in Urmia. This approach ensured ethical approval and compliance with health standards for individuals diagnosed with PD in the community. Two copies of the written consent forms were prepared, with one copy given to the participant and the other retained by the researcher. Subsequently, demographic information of the patients was recorded, along with their medication history. Following this, the 14-item OHIP-14 questionnaire¹⁷, along with an assessment form of oral health behaviors (including the frequency of toothbrushing and dental flossing per day for patients with natural teeth or dental prostheses, the hours of full denture use per day for edentulous patients, the frequency of denture cleaning per day for edentulous patients, and the frequency of mouthwash use per day for all Parkinson's patients), was verbally completed. It is worth mentioning that the questionnaires were completed for all participants (literate and illiterate) through interviews to enhance accuracy and avoid data-entry errors by the researchers themselves.

Objective assessment, including the evaluation of oral characteristics such as the number of remaining teeth and the DMFT index, was conducted on Parkinson's patients by a dental student. The DMFT index was documented for Parkinson's patients. Intraoral examination was performed using tools that included dental mirrors, probes, single-use latex gloves, and triple-layer masks.

In cases of Parkinson's patients, referred by a neurologist, who were eligible but unable to visit a clinic or hospital, the researcher obtained consent from the patients or their representatives. Subsequently, the questionnaires were completed, and the intraoral examinations were conducted via a telephone call. Upon obtaining written and verbal consent from the patients or their representatives at their residence, the researcher completed the questionnaires and performed the intraoral examinations on-site. To collect a control group sample of healthy individuals, a random sampling method was employed. Subsequently, the DMFT index was clinically measured by a dental student in a manner similar to the patient group. The healthy individuals were matched with the patient group based on age and gender. The oral examinations of the control group members were conducted at dental units within the dental clinic of the Urmia School of Dentistry. In assessing the DMFT index, if a tooth was extracted or prescribed for extraction, it was categorized as "Missed." Teeth restored with amalgam, resin, or prosthetic crowns were categorized as "Filled."

To compare average QoL between patients with Parkinson's and healthy individuals, the Mann-Whitney U test was used. To examine the correlation between QoL and duration of PD among patients, and the correlation

between QoL and the DMFT index in Parkinson's patients and healthy individuals, Spearman's correlation coefficient was employed. For comparing OHRQoL and the DMFT index while adjusting for the effects of age and education level, a one-way analysis of covariance ANCOVA test was utilized.

To address the potential confounding effects of age and education level, rigorous statistical methods were employed. Specifically, a one-way ANCOVA was used to compare OHRQoL and the DMFT index between patients with Parkinson's and healthy controls, with age and education included as covariates to adjust for their influence. Given the statistically significant differences in the mean scores of QoL and DMFT between Parkinson's patients and healthy individuals based on age and gender distributions, linear regression analysis was applied to simultaneously adjust the effects of these variables. All data analyses were performed using SPSS version 20, with the significance level set at $P < 0.05$.

Results

This study included 133 participants, comprising 67 Parkinson's patients and 66 healthy individuals. The mean age ($\pm$ standard deviation) of the Parkinson's group was 67.9 ± 9.66 years, while that of the control group was 63.03 ± 8.62 years.

Table 1 presents the sociodemographic characteristics of the participants, showing statistically significant differences in age ($P = 0.01$) and educational attainment ($P < 0.001$) between Parkinson's patients and healthy individuals. However, gender distribution did not differ significantly between the two groups.

The results revealed a statistically significant difference in OHRQoL between Parkinson's patients and healthy individuals, as indicated by higher OHIP-14 scores (15.03 ± 9.42 vs. 10.3 ± 9.26 , $P = 0.002$). This suggests that Parkinson's disease negatively impacts oral health and overall well-being.

Gender-based analysis showed that male Parkinson's patients had significantly worse OHRQoL scores (14.05 ± 8.75) compared to healthy males (9.17 ± 8.45 , $P = 0.007$). However, no significant difference was observed between female participants in the two groups ($P = 0.06$) (Table 2).

Table 3 indicates that the mean QoL score was significantly higher in Parkinson's patients compared to healthy individuals. The difference in mean QoL scores between the two groups was statistically significant ($P = 0.001$). This significant difference was observed in both females and males, with Parkinson's patients having higher DMFT scores than healthy individuals in both gender groups. After adjusting for age, the mean DMFT score in Parkinson's patients was significantly higher than in healthy individuals ($P = 0.007$). However, the mean DMFT score was not statistically significant after adjusting for education level ($P = 0.11$).

The results presented in Table 4 demonstrate a significant positive correlation between the duration

of Parkinson's disease and QoL scores (Spearman's $\rho=0.37$, $P=0.002$). Similarly, a significant positive correlation was observed between the DMFT index and disease duration ($r=0.31$, $P=0.006$), indicating that the longer disease duration, the poorer oral health outcomes and reduced QoL.

Discussion

This study aimed to assess OHRQoL in individuals with PD compared to healthy controls. The results demonstrated significantly higher OHIP-14 scores among patients with PD, indicating poorer OHRQoL. As higher OHIP-14 scores reflect a greater burden of oral

health-related challenges. These findings underscore the detrimental impact of Parkinson's disease on both oral health and overall well-being.

Despite receiving regular and often comprehensive medical care—including dental services—individuals with PD may still experience deteriorating oral health due to disease-specific challenges. Notably, Vorheof et al. reported contradictory findings, indicating lower OHRQoL scores in children with PD compared to healthy peers.¹⁸ Conversely, Barbe et al. observed significantly lower OHRQoL among German PD patients with oral manifestations such as xerostomia, drooling, and dysphagia, compared to healthy controls.¹⁹

Table 1. Sociodemographic Characteristics of the Studied Patients

Variables	Parkinson's patient's	Healthy individuals	P value
Age (Mean±SD)	67.9(9.6)	63.03(8.6)	0.01
Duration of illness (Mean±SD)	5.54(4.3)		
Gender			0.72
	Female	28(41.8)	
	Male	39(58.2)	
Education			0.001
	Illiterate / Elementary school	17(25.4)	
	Middle school	20(29.9)	
	High school	21(31.3)	
	University	9(13.4)	

Table 2. Comparison of mean OHIP-14 scores between Parkinson's patients and healthy controls

OHRQoL Scores	Parkinson's patient's	Healthy individuals	P value
OHRQoL (Mean±SD)	15.03(9.42)*	10.3(9.26)*	0.002*
OHRQoL in Female (Mean±SD)	16.39(10.26)	12.08(10.24)	0.06
OHRQoL in Men (Mean±SD)	14.05(8.75)*	9.17(8.45)*	0.007*
OHRQoL Adjusted for Age (Mean±SD)	15.22(1.15)**	10.07(1.16)**	0.002**
OHRQoL Score Adjusted for Education Level (Mean±SD)	14.77(1.22)	11.51(1.42)	0.12

OHRQoL: Oral health-related quality of life

* Mann-Whitney U Test

** ANCOVA

Table 3. Comparison of mean DMFT index between groups adjusted for age and education level

DMFT	Parkinson's patient's	Healthy individuals	P value
DMFT (Mean±SD)	81.28(23.47) *	64.73(31.41)*	0.002*
DMFT in Female (Mean±SD)	79.21(23.23)*	58.28(32.44)*	0.01*
DMFT in Male (Mean±SD)	82.77(23.82)*	68.66(30.5)*	0.03*
DMFT Adjusted for Age (Mean±SD)	79.42(3.25)**	66.62(3.28)**	0.007**
DMFT (Mean±SD) Adjusted for Education Level	80.7(3.41)**	70.82(3.97)**	0.11

DMFT: Decayed, Missing, and Filled Teeth

*Independent t-test

** ANCOVA

Table 4. Correlation between PD duration, QoL, and DMFT index

Variables	QoL			DMFT		
	r	95% Confidence Interval	P value	r	95% Confidence Interval	P value
Male Gender Compared to Female	-2.4	(-5.68-0.89)	0.15	4.41	(-4.92-13.74)	0.35
PD	4.98	(1.72-8.25)	0.003	13.10	(22.37- 3.84)	0.006*
Age	-0.08	(-0.26-0.09)	0.35	0.94	1.44)- 0.43)	<0.001**

*DMFT: Decayed, Missing, and Filled Teeth; PD: Parkinson's Disease; QoL: Quality of Life

*Spearman's correlation coefficient

**ANCOVA

These discrepancies may arise from differences in study populations. For instance, the average age of PD patients in the present study was higher than that of healthy individuals, whereas the opposite was true in the studies by Vorheof et al.¹⁸ and Barbe et al.¹⁹ who reported the opposite results. Additionally, differences in healthcare systems, treatment practices, and preventive behaviors across different communities may contribute to varying study outcomes. Furthermore, the tools used to assess QoL in various studies also differ; as in our study a patient-reported questionnaire was employed.

Moreover, the mean DMFT index was significantly higher in the PD group. This can be attributed to motor dysfunction commonly observed in PD—such as tremors, bradykinesia, and rigidity—which impairs patients' ability to perform adequate oral hygiene practices, leading to increased plaque accumulation, dental caries, and periodontal disease. Neurodegenerative changes may also predispose individuals to parafunctional habits such as bruxism, contributing to tooth wear and eventual tooth loss. These findings are consistent with those reported by Van Stiphout et al, who emphasized the challenges PD patients face in maintaining effective oral hygiene.²⁰ Other studies have similarly linked neurodegenerative disorders with elevated DMFT indices through comparable pathophysiological mechanisms.²¹

Poor oral hygiene in PD may also lead to recurrent infections and inflammation of dental nerves, which are emerging as potential contributors to PD pathology.²² Dietary habits also play a significant role, as individuals with PD tend to consume more sweets compared to healthy individuals.²³ This higher consumption of sugary foods can exacerbate dental decay, underscoring the importance of diet in the occurrence of dental caries among Parkinson's patients.

In addition to dietary habits, other potential confounding factors must be considered when evaluating oral health in individuals with PD. Medication side effects, particularly xerostomia (dry mouth) induced by PD treatments, may significantly increase the risk of dental caries and contribute to overall poor oral health. Furthermore, socioeconomic status—including access to dental care and levels of health literacy—plays a crucial role in shaping both oral health outcomes and self-reported quality of life.

This study found no significant correlation between the mean DMFT score and the OHRQoL score among participants.

However, these findings contrast with those of Vorheof et al, who demonstrated that deterioration in oral health among PD patients—due to reduced ability to swallow and chew food—negatively impacted their OHRQoL.¹⁸ Similarly, contradictions were observed regarding other factors; for instance, findings have shown that the OHIP-14 score was lower in individuals with PD and periodontitis compared to healthy individuals.²⁴ These discrepancies highlight the complex interactions between PD, oral health conditions, and their impact on OHRQoL,

emphasizing the need for further research to better understand these correlations and their implications for patient care.

The findings of this study also revealed that individuals with PD were more likely to use fully removable dentures compared to healthy individuals. Additionally, the prevalence of partial denture use was higher among Parkinson's patients than among healthy individuals, although this difference was not statistically significant. Ribero et al. reported that PD patients with complete or partial edentulism exhibited lower OHRQoL compared to healthy individuals; however, both groups showed substantial improvement in OHRQoL two months after prosthetic treatment.²⁵ Furthermore, a systematic review indicated that individuals with edentulism using either full or partial dentures experience up to 4.1 times higher satisfaction with OHRQoL compared to edentulous individuals without prosthetic appliances.²⁶ These results emphasize the beneficial impact of prosthetic treatment on OHR QoL in individuals with PD, highlighting the importance of comprehensive dental care in enhancing their well-being. The findings of this study indicated a significant and positive correlation between the mean QoL score of PD patients and the duration of the disease. These findings may be attributed to the relatively short duration of PD. Many Parkinson's patients experience a phase known as the "honeymoon period" during the first 10 years of the disease, where they are asymptomatic and respond well to medication without noticeable symptoms.²⁷ Upon transitioning from this phase, symptomatic onset begins, significantly impacting the patient's QoL.

This study found no significant difference in the mean OHRQoL score between females with PD and healthy female participants. However, the mean DMFT index was significantly higher in females with PD compared to their healthy counterparts. The absence of a significant difference in OHRQoL among females may be attributed to gender-specific factors influencing PD pathophysiology. Existing evidence suggests that the onset and progression of PD symptoms in females tend to be milder, potentially due to the neuroprotective effects of estrogen.²⁸ Additionally, studies have reported a higher prevalence of sialorrhea (drooling) among male PD patients compared to females, which may contribute to greater discomfort and impaired OHRQoL in males.²⁹

Decreased OHRQoL negatively affects individuals' perceptions of their oral health and general well-being. Moreover, worsening oral health may lead to complications such as swallowing disorders, which are recognized as risk factors for cognitive impairment and weight loss—phenomena particularly relevant to individuals with PD.³⁰ Cognitive impairment is among the most common non-motor symptoms in PD and may further hinder the ability to maintain adequate oral hygiene, compounding oral health challenges and diminishing overall QoL.

In settings where individuals require primary oral healthcare, the decline in both QoL and oral health poses an additional burden on healthcare systems. To mitigate

this, health policymakers should prioritize PD patients in oral health programs by advocating for educational initiatives that promote consistent oral hygiene practices and by establishing structured oral health monitoring systems. Furthermore, the role of dentists is vital, emphasizing the importance of routine consultations and multidisciplinary collaboration with physicians and neurologists.³¹ Evidence also suggests that improved oral hygiene practices and targeted education enhance facial motor function and chewing ability, contributing to better QoL among PD patients.³²

Limitations of the Study

Several potential confounding factors may have influenced the outcomes of this study. First, dietary habits—such as increased consumption of sugary foods, which has been occasionally reported among individuals with Parkinson's disease—may have contributed to a heightened risk of dental caries and diminished oral health status. Second, the adverse effects of antiparkinsonian medications, particularly xerostomia (dry mouth), could reduce salivary flow and thereby increase susceptibility to dental decay. Third, socioeconomic determinants—including access to dental care services, health literacy levels, and the affordability of oral healthcare—can substantially affect both clinically assessed oral health outcomes and patient-reported quality of life measures. While adjustments were made for age and educational attainment, these additional variables were not controlled for, potentially limiting the internal validity and generalizability of the findings. Future research should aim to incorporate a more comprehensive set of confounders and utilize more robust methodological designs, such as prospective cohort's studies, to strengthen causal inference.

Suggestions for Future Studies

Future research should consider employing longitudinal study designs to examine how oral health-related quality of life (OHRQoL) evolves over the course of Parkinson's disease. Tracking changes over time may offer more comprehensive insights into the dynamic interaction between disease progression and oral health outcomes. Additionally, incorporating detailed clinical evaluations of both motor and non-motor symptoms—such as tremors, dysphagia, and xerostomia—could enhance understanding of their individual and combined effects on oral health. It is also important to explore the role of antiparkinsonian medications, particularly their side effects like dry mouth, in contributing to oral health deterioration. Furthermore, future studies would benefit from adjusting for a broader range of confounding variables, including socioeconomic status, dietary patterns, and access to dental care. Applying stratified analyses or multivariable regression techniques may improve the accuracy and generalizability of findings by isolating the independent influence of Parkinson's disease on oral health and quality of life.

Conclusion

This study illustrated significant insights into OHRQoL in PD, demonstrating the higher perceived QoL scores despite elevated dental decay indices. This discrepancy underscores the nuanced impact of neurodegenerative symptoms on OHRQoL outcomes. While patients benefit from adaptive strategies and comprehensive healthcare, including dental interventions, the lack of correlation between dental status and QoL highlights the multifactorial nature of oral health challenges in PD. Moving forward, tailored oral health education and integrated care approaches are crucial to mitigate these challenges and improve overall well-being in this patient population.

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Competing Interests

None.

Consent for Publication

Not applicable.

Data Availability of data and materials

The dataset analyzed in the current study is available from the corresponding author upon a reasonable request.

Ethical Approval

The study process was reviewed and approved by the Ethics Committee of Urmia University of Medical Sciences, in accordance with the Declaration of Helsinki (Ethics Code: IR.UMSU.REC.1402.198).

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