




# Evidence-Based Recommendations for the Oral Health of Patients with Parkinson's Disease

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## ABSTRACT

**Introduction:** Patients with Parkinson's disease (PD) present a variety of oral disease that can be worsened by xerostomia and sialorrhea. The patients' physical limitations, for example rigidity and tremor, add to the difficulty of oral care by the general dental surgeon. The objective of the present review was to organize a list of evidence-based recommendations for the oral care of patients with PD.

**Methods:** A systematic review of the literature was carried out by specialists who selected the relevant papers and created a list of recommendations based upon the literature.

**Results:** Fourteen papers (data reported in 16 articles) were included in this review. Patients with PD had reduced quality of oral health and hygiene, and high prevalence of gingival recession, periodontal disease, dental calculus, tooth decay, tooth mobility and loss, drooling, xerostomia, dysphagia and temporomandibular

disorders. Most studies offered class IV evidence, while one paper had class II evidence.

**Conclusion:** Patients with PD present poor oral health with conditions that are mostly preventable.

**Keywords:** Dentistry; Movement disorders; Neurology; Oral health; Parkinson

### Key Summary Points

Patients with Parkinson's disease (PD) present a variety of oral disease that can be worsened by xerostomia and sialorrhea.

A systematic review of the literature was carried out and a list of recommendations has been created.

Patients with PD present poor oral health with conditions that are mostly preventable.

Routine consultations with dental surgeons may improve the quality of life of patients with PD.

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## DIGITAL FEATURES

This article is published with digital features, including a summary slide, to facilitate understanding of the article. To view digital features for this article go to <https://doi.org/10.6084/m9.figshare.14096261>.

## INTRODUCTION

Parkinson's Disease (PD) is one of the most frequent neurodegenerative diseases, characterized by motor, autonomic, cognitive and behavioral symptoms [1]. Patients with PD will live with this condition from its onset until death, undergoing a variety of pharmacological and/or non-pharmacological treatments. At disease onset, often concerned with mobility limitations, the patient and the physician will focus on this aspect of the disease. Subsequently, cognitive and behavioral symptoms may add to the disease burden, while superimposed autonomic dysfunction makes PD management particularly challenging [2]. Faced with these myriad disabling symptoms, it is not unexpected that oral health may become a secondary aspect of the patients' lives.

The interdisciplinary approach to patients with PD is highly recommended, but it is not common to have a dentist in the group [3]. Oral care of these patients is often neglected by the patients and their caregivers and physicians [4]. Some diseases reported in patients with PD include increased prevalence of caries and periodontal disease, sialorrhea and drooling, xerostomia, orofacial pain, bruxism and taste impairment [4]. The physiopathology of oral disorders in patients with PD is complex and is not fully understood. Drooling, for example, can be caused by dopamine-induced increased speed of salivary excretion, increased salivary flow rate swallowing dysfunction, hypomimia, lingual bradykinesia and abnormal flexed posture in a patient with reduced salivary production [5]. Although the association between xerostomia and drooling may seem paradoxical, in PD these two conditions may often occur together [5]. In addition, chronic oral inflammation by *Porphyromonas gingivalis*, a keystone

pathogen in periodontitis, causes microbial dysbiosis typical of the neuroinflammation [6]. Periodontal disease has been considered a feature of PD due to poor motor and cognitive control, leading to poor oral health maintenance [7, 8]. However, the association between the two conditions may be two-sided. Chronic neuroinflammation is consistently associated with the pathophysiology of PD and is one of the contributing factors for neurodegeneration [8]. *P. gingivalis* may be associated with the development of PD and may be more frequent in patients with periodontal disease [7].

The objective of the present study was to review different aspects of oral health in PD and to establish evidence-based recommendations for the prevention and treatment of oral cavity diseases.

## METHODS

### Eligibility Criteria for Including Studies

Clinical trials and observational studies assessing different aspects of oral health among patients with PD were included in this review. These involved associations between different aspects of PD and oral cavity diseases, along with any type of treatment or preventive strategies. Case reports, reviews, guidelines and experimental studies were excluded. This article is based on previously conducted studies and does not contain any new studies with human participants or animals performed by any of the authors.

### Search Strategies for Identifying Studies

A comprehensive and sensitive search was conducted first on 24 March 2020 and then updated on 23 November 2020, in the following electronic databases: MEDLINE (via PubMed), Embase (via Elsevier), Cochrane Central Register of Controlled Trials (CENTRAL), Latin American & Caribbean Health Sciences Literature (LILACS) (via Biblioteca Virtual em Saúde, BVS) and Brazilian Bibliography of Odontology (BBO) (via BVS). We also hand-searched the

reference lists of relevant studies to identify any potentially eligible study. The full search strategies are presented in Supplementary File 1. There were no language or date restrictions.

### Selection of Studies and Data Extraction

Two authors independently reviewed the title and abstracts recovered through the search using the Rayyan platform [3]. References identified as “potentially eligible” were analyzed in full text. Any disagreement was resolved by a third reviewer.

Data extraction from the studies included was performed by four independent reviewers using a pre-established data extraction form. The data gathered comprised the main characteristics of the studies included (study design, sample size, participant characteristics, intervention and comparator groups, outcomes assessed, follow-up and results). Any disagreement was resolved by two other review authors.

### Data Synthesis

The results from the studies included were presented narratively in accordance with the hierarchy of evidence levels [4].

## RESULTS

Through the search strategies, a total of 121 references were retrieved. After removed 17 duplicates, 104 were screened using their titles and abstracts, and out of these, 41 potentially eligible references were analyzed in full text. Twenty-two studies did not meet the inclusion criteria and were excluded (reviews and case reports). Two other studies were excluded because they dealt with oral-related risk factors associated with the development of PD in previously healthy individuals. One study was excluded because it only discussed the reduction in the risk of developing PD when an individual underwent dental scaling [5]. This study compared two populations: 4765 adults with PD and 19,060 age-matched individuals without PD. Another study [6] investigated data

from 20,175 individuals who were free from PD in 1973 and 1974, regarding the evolution of their health up to 2012. Among men, use of tobacco was associated with a lower risk of developing PD, but their number of teeth and the presence of plaque were not associated with having PD after 28 years of follow-up.

Thus, 14 studies (reported in 16 papers) were included in this review [7–22]. Figure 1 shows the study selection process. Table 1 shows a summary of the data retrieved from the 16 articles that were included in the systematic review, along with the level of evidence for each of them. In summary, the studies pointed out that patients with PD had reduced quality of oral health and hygiene. Presence of PD was associated with gingival recession, periodontal disease, dental calculus, tooth decay, tooth mobility and loss, drooling, xerostomia, dysphagia and temporomandibular disorders. Except for one study with class II evidence [7], all the papers had class IV evidence.

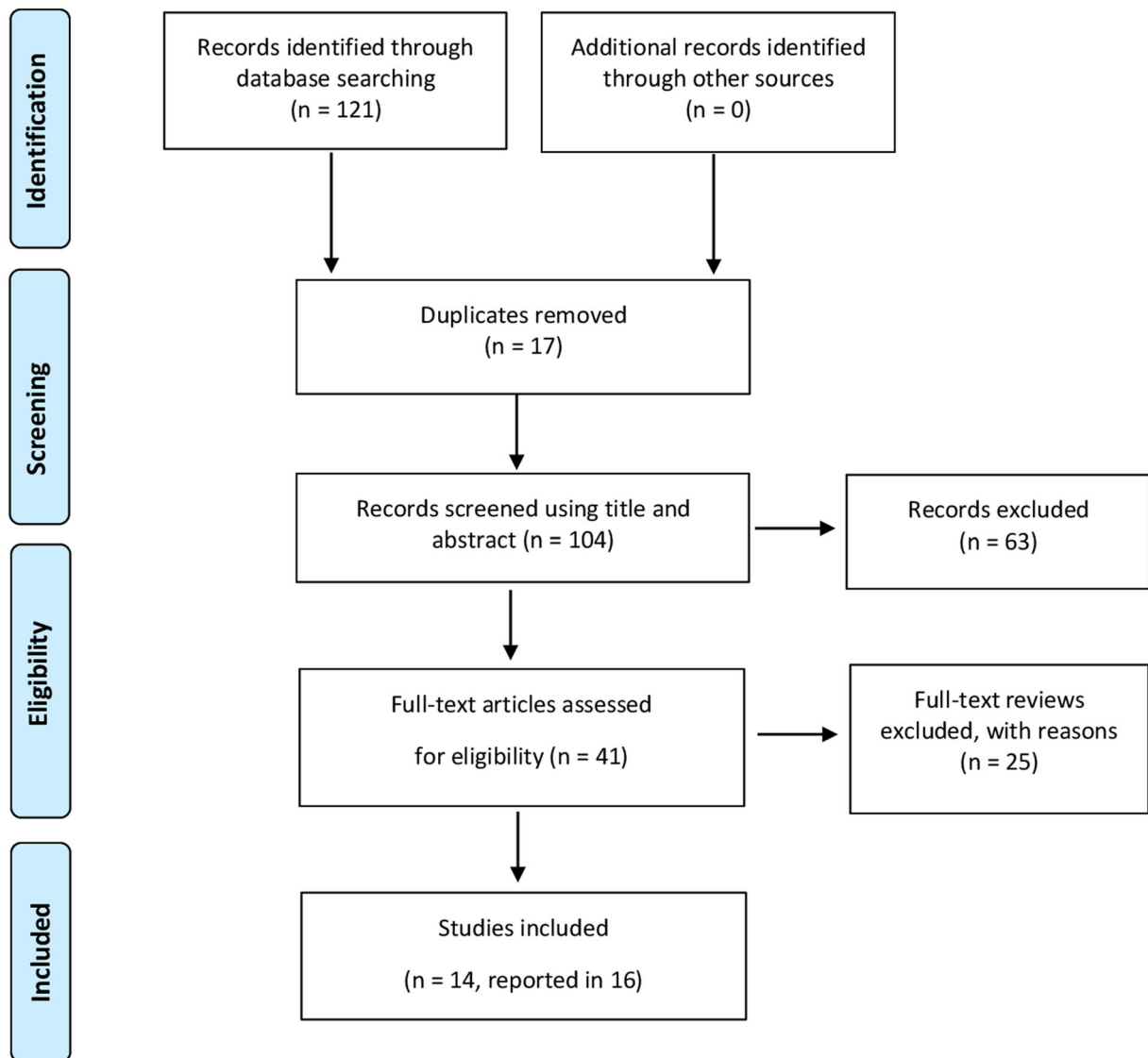
## DISCUSSION

There is no question that oral health is important for everyone. Although oral diseases are largely preventable, they are among the most prevalent diseases globally, thus creating a public health problem [23].

Despite the relatively low level of evidence in studies on oral health among patients with PD, the data retrieved for this systematic review allowed us to create a set of simple guidelines. We thus created a list of practical, evidence-based recommendations for all neurologists and dentists who treat patients with PD.

### General Dental Care

- o During neurological consultations, the physician needs to introduce the issue of visits to a dentist.
- p Should the patient not have regular dental appointments, the neurologist should refer this individual to an oral health care center.
- q Teeth brushing needs to be done regularly and should be performed alternating the right and the left hands, since rigidity and



**Fig. 1** Flowchart of article selection for the systematic review

tremor may be more disabling in one limb as PD progresses. Therefore, the patient should learn to use either hand for oral hygiene.

- r Individualized instructions regarding oral hygiene, together with chewing and lip exercises, can improve oral health in PD cases [7].

### Salivation

- o PD is associated with hyposalivation or xerostomia (autonomic and anticholinergic

drugs), drooling (motor or dysphagia) and halitosis. [11–13, 16]. The neurologist and the dentist should assess these conditions and establish the best possible approach to control them.

- p Low salivary flow can be relieved through artificial saliva spray [24].
- q Botulinum toxin applied to the parotid and submandibular glands can relieve drooling [25]. However, this procedure may increase xerostomia, and the risk/benefit ratio must be assessed carefully (Fuster Torres et al. [26]).

**Table 1** Summary of the studies included in the systematic review

Author/ year/country	Study design/level of evidence	Participants	Interventions/exposure	Results
Baram et al. [7] Denmark	RCT Level II	$n = 29$ Median 65 years Moderate to advanced PD	G1: Individual dental hygiene instruction, training of jaw opening, and lip and chewing exercises ( $n = 15$ ) G2: Only instructions ( $n = 14$ )	G1 patients improved jaw opening, chewing time and hygiene after 2 months No significant changes were found among G2 patients after 2 months
Zarpelon et al. [8] Brazil	Cross- sectional Level IV	$n = 50$ Aged 53–94 years Mild PD	Oral cavity examination to assess prosthetic use and need; index of DMFT; CPI; PAL; and oral mucosa	92% prosthetic use in upper arch 66% prosthetic need in lower arch 43% missing teeth (DMFT) 43% dental calculus (CPI) 28% attachment loss (PAL) Findings in oral mucosa: denture stomatitis, inflammatory fibrous hyperplasia
Silva et al. [9] Brazil	Cross- sectional Level IV	$n = 59$ Age 50–75 years 83% mild PD	Signs and symptoms of TMD with RDC/TMD	Prevalence of TMD 20.3% ( $n = 12$ ) More frequent among women ( $n = 7$ ) No significant association between TMD and PD severity
van Stiphout et al. [10] Netherlands	Case–control Level IV	$n = 74$ with PD $n = 74$ without PD Aged 40–69 years	Oral health status and PD duration and severity	Patients with PD had weakened oral health status and reduced oral hygiene care PD duration and severity were associated with poor oral health and hygiene care problems
Tiigimäe- Saar et al. [11] Estonia	Case–control Level IV	$n = 12$ with PD $n = 13$ without PD $n = 13$ healthy subjects mean age of 71.1 years	Botulinum toxin type A for sialorrhea (bilateral parotid and submandibular glands)	Decrease in salivary flow at 1 month No changes in salivary composition Increased levels of <i>Lactobacilli</i> count, which can have a negative effect on PD No adverse events observed

**Table 1** continued

Author/ year/country	Study design/level of evidence	Participants	Interventions/exposure	Results
Barbe et al. [12, 13] Germany	Case-control Level IV	<i>n</i> = 26 with PD  <i>n</i> = 26 without PD  Mean age 69 years	Halitosis and PD	More patients with PD perceived halitosis to be stronger (77% vs. 54%)  Dry mouth was more frequent among PD patients  OHRQoL lower among patients with PD  Patients with PD had more hyposalivation (87% vs. 50%)  50% reported xerostomia, vs. none of controls
Ribeiro et al. [14, 15] Brazil	Case-control Level IV	<i>n</i> = 17 with PD  <i>n</i> = 17 without PD  Mean age 69.4 years	Oral rehabilitation with a removable prosthesis and PD	Improved OHRQoL and masticatory efficiency 2 months after intervention in both groups  No group differences in the number of remaining teeth, DMFT, VPI or salivary flow rate  Lower GOHAI scores among patients with PD  Patients with PD had more negative self-perceptions of their oral health
Barbe et al. [16] Germany	Cross- sectional Level IV	<i>n</i> = 100  Mean age 71 years	Self-assessed dental care: ability to perform oral hygiene, self-assessed xerostomia, drooling and dysphagia problems, and the impact on OHRQoL	49% xerostomia, 70% drooling and 47% dysphagia  29% with limited ability to perform oral hygiene  Xerostomia, drooling, and dysphagia impaired the OHRQoL  6.1% of participants with xerostomia received advice regarding management
Bonenfant et al. [17] Canada/ France	Cross- sectional Level IV	<i>n</i> = 203  Mean age 68.2 years	Frequency of BMS among PD patients	Low prevalence of BMS among patients with PD (4%)  Poor oral health index was higher with BMS than without BMS

**Table 1** continued

Author/ year/country	Study design/level of evidence	Participants	Interventions/exposure	Results
Pradeep et al. [18] India	Case–control Level IV	<i>n</i> = 45 with PD <i>n</i> = 46 without PD  Mean age 58.7 years	Periodontal status and severity of PD	All the periodontal clinical parameters and indices evaluated deteriorated with increasing severity of PD
Cicciù et al. [19] Italy	Case–control Level IV	<i>n</i> = 45 with PD <i>n</i> = 45 without PD  Mean age 65 years	Periodontal status and severity of PD	Higher frequency of untreated caries, periodontal diseases and missing teeth among patients with PD
Müller et al. [20] Germany	Case–control Level IV	<i>n</i> = 101 with PD <i>n</i> = 75 without PD  Mean age 66.2 years	Oral health and PD	Patients with PD had poorer oral health (papilla bleeding index), gingival recession and tooth mobility, lower frequency of teeth brushing, longer time since the last dentist visit and reduced salivary flow
Bakke et al. [21] Denmark	Case–control Level IV	<i>n</i> = 15 with PD <i>n</i> = 15 without PD  Aged 62–81 years	Orofacial function and oral health among PD patients	Patients with PD had more prevalent orofacial dysfunction, poorer mastication and jaw opening and negative impact of oral health on daily life
Packer et al. [22] United Kingdom	Cross-sectional Level IV	<i>n</i> = 9 with PD All men  Aged 54–77 years	QoL of patients with PD with implants	Dental implants had 82% success rate and improved both oral and general QoL among patients with SD

*RCT* randomized clinical trial, *n* number of participants, *PD* Parkinson's disease, *G* group, *DMFT* decayed, missing and filled teeth, *CPI* Community Periodontal Index, *PAL* periodontal attachment loss, *TMD* temporomandibular disorder, *RDC/TMD* Research Diagnostic Criteria for Temporomandibular Disorders, *PID* periodontal inflammatory disease, *OHRQoL* oral health-related quality of life, *VPI* visible plaque index, *GOHAI* General Oral Health Assessment Index, *BMS* burning mouth syndrome, *QoL* quality of life

- r Photodynamic therapy on the tongue surface may be a good option for halitosis [27].

### Tooth Decay and Loss

- o Patients with PD have a higher frequency of untreated caries [19, 20]. This can be corrected through regular dental appointments.
- p Tooth loss can be successfully corrected through osseointegrated implants, as shown in nine patients with PD and tooth loss in an open, uncontrolled study [22]. Partial and complete prostheses have also been presented as an alternative to tooth loss [14, 15, 28]. However, it needs to be kept in mind that placing dentures and keeping them functional may be a burden for patients with tremor, rigidity, xerostomia and drooling. In addition, denture stomatitis and inflammatory fibrous hyperplasia have been reported in patients with PD using dentures [8]. Therefore, whenever possible, osseointegrated implants are recommended.

### Periodontal Disease

- o PD is associated with gingival recession and bleeding, plaques, dental calculus and tooth mobility [8, 18–20]. Improved hygiene may ultimately lead to lower rates of periodontal disease and, consequently, less tooth loss. Regular visits to a periodontist should be encouraged.

### Temporomandibular Disorder (TMD)

- o Patients with PD showed a higher prevalence of TMD, particularly women [9, 21]. While around 20% of patients with PD show signs and symptoms of TMD, the elderly population generally has a 12% prevalence of temporomandibular dysfunction [29]. Less than 4% of elderly subjects have severe TMD [30].
- p Untreated TMD may add to the burden of PD, by generating greater pain and orofacial

dysfunction. TMD needs to be investigated and treated.

### Burning Mouth Syndrome (BMS)

- o Although the prevalence of BMS is not higher than 4% among patients with PD, this condition has been correlated with poor oral conditions [17]. Therefore, to avoid adding a burden of BMS to individuals already presenting with disability, good oral health needs to be maintained among patients with PD.

## CONCLUSIONS

Patients with PD have a variety of oral diseases that needs to be prevented, diagnosed and treated. The present paper provides a list of evidence-based recommendations for neurologists and dentists caring for these patients.

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**Compliance with Ethics Guidelines.** This article is based on previously conducted studies and does not contain any new studies with



human participants or animals performed by any of the authors.

**Data Availability.** Data sharing is not applicable to this article as no data sets were generated or analyzed during the current study.

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