

# Oral Health in Elders with Parkinson's Disease

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This study aimed to evaluate objectively and subjectively the oral health of elders with Parkinson's disease (PD), using clinical oral assessments and the General Oral Health Assessment Index (GOHAI). Subjects included 37 removable prosthesis wearers, 17 with PD (mean age  $69.59 \pm 5.09$  years) and 20 without PD (mean age  $72.00 \pm 5.69$  years). The objective assessment included an evaluation of oral characteristics, including the number of remaining teeth, decayed, missing and filled teeth (DMFT), visible plaque index (VPI), salivary flow rate and removable prosthesis conditions. The subjective assessment included self-perception of oral health collected using the GOHAI index. The number of remaining teeth, DMFT, VPI, salivary flow rate and GOHAI data were compared between the groups using t-tests. Removable prosthesis conditions were analyzed using  $\chi^2$  tests ( $p < 0.05$ ). There were no group differences in the number of remaining teeth, DMFT, VPI or salivary flow rate ( $p > 0.05$ ). Greater maxillary prosthesis defects were observed in the control group ( $p = 0.037$ ). GOHAI scores were low for the PD group and moderate for controls, yielding a group difference ( $p = 0.04$ ). In conclusion, elders with PD have similar oral health to controls. Although all elders had few remaining teeth, high DMFT and high VPI, PD elders had more negative self-perceptions of their oral health than did the controls.

Key Words: Parkinson's disease, oral hygiene, oral health, removable dental prosthesis.

## Introduction

Parkinson's disease (PD) is the second most common neurodegenerative disorder. It is characterized by intracellular  $\alpha$ -synuclein-positive inclusions called Lewy bodies and by nigrostriatal cell loss, which cause motor and non-motor symptoms (1). Cardinal motor symptoms include resting tremor, bradykinesia, rigidity and postural instability (2), and diagnosis requires the presence of at least two of these symptoms, coupled with asymmetric symptom onset and a good response to levodopa (1). Non-motor symptoms occur in over 90% of patients across all stages and include neuropsychiatric and autonomous dysfunction, such as depression, anxiety, apathy, cognitive and sleep disturbances, sensory symptoms, fatigue and pain (3).

Motor symptoms may interfere with automated small hand movements (4), causing impairment in toothbrushing ability, which is considered a primary risk factor for deteriorated oral health in PD patients (5). In addition to non-motor symptoms, such as dementia or apathy, altered motor behavior and particularly motor fluctuations may influence the quality and frequency of daily oral hygiene care by these patients (5).

Results of studies assessing oral health in patients with PD have been controversial (5,7-9). Surveys with larger number of participants showed that PD patients have more missing teeth, caries, dental biofilm (7) and poorer periodontal health (5,8) compared with individuals without the disease (7). In contrast, Fukayo et al. (6) found that PD patients had significantly more teeth and less caries than a

control group of similar age (6). These controversial results underscore the need for further studies of oral health in PD patients.

Oral health means more than good teeth; it is a component of general health essential for well-being (8). Assessment of oral health, based solely on clinical diagnosis by dentists, often leads to an overestimation of the true need for treatment in elders (9) because it does not evaluate self-perceptions about oral health. Self-perception of oral health is a multidimensional measurement that reflects individuals' subjective experience of their functional, social and psychological well-being (10), and often motivates seeking dental treatment (11). Subjective assessments (12,14) were developed to enhance the clinicians' ability to assess self-perception of oral health and oral health-related quality of life in elders.

Previous studies in patients with PD assessed subjective data using a structured questionnaire (13) and Oral Health Impact Profile (OHIP) (9,16). The former (13) demonstrated that compared with the controls, PD patients complained more about their oral health due to chewing difficulties, denture discomfort and problems with oral health behavior. Subjective assessments using OHIP (14,15) also showed that PD patients reported more oral health-related problems than controls (14) and that the oral health impact in PD patients was greater on the "physical disability" and "psychological discomfort" subscales (15). However, studies evaluating self-perception of oral health in PD patients

using the General Oral Health Assessment Index (GOHAI) have not been published yet.

Due to the controversial literature on oral health in PD subjects and their greater oral health complaints, additional studies in this area are required. Therefore, the present study aimed to evaluate the oral health of elders with PD both objectively and subjectively, using oral assessments and the GOHAI, respectively.

## Material and Methods

### Subjects

This cross-sectional study included 17 elders with PD (mean age  $69.41 \pm 4.65$  years; 8 women and 9 men), members of the Brazilian Parkinson's Association (Piracicaba, SP, Brazil) and 20 elders without PD (mean age  $72.00 \pm 5.69$ ; 10 women and 10 men), chosen among friends and relatives of the PD volunteers or from elders who sought prosthetic treatment at the dental clinic of the Piracicaba Dental School, Universidade Estadual de Campinas, Brazil. All PD subjects were diagnosed by a neuropsychiatrist using clinical diagnostic criteria (16), were receiving daily levodopa treatment, and had a mean of  $6.76 \pm 3.80$  years since PD diagnosis. Elders with other neurodegenerative disorders or secondary Parkinsonism were excluded from the study. All participants gave written informed consent. The institutional Ethics Committee approved the study (protocol #097/2012). The study was also registered at the Brazilian Registry of Clinical Trials database (#RBR-3czhsf), which is linked to the International Clinical Trials Registration Platform (ICTRP/World Health Organization).

Sociodemographic characteristics including age, educational level and monthly income were collected. Characteristics of the prostheses were verified, including the type of maxillary and mandibular removable dental prosthesis and prosthesis age.

### Objective Assessment

To assess oral health, all participants were subjected to clinical examination made using a probe, mouth mirror and flashlight. Each subject's teeth, hygiene and removable dental prosthesis conditions were evaluated as follows:

(1) Number of remaining teeth: the number of teeth present in the mouth was recorded in the partially dentate volunteers.

(2) Decayed, missing and filled teeth (DMFT) index (17): the teeth were categorized as decayed if they were cavitated; missing if they were extracted or extraction was indicated; and filled if they presented amalgam, resin or prosthetic crowns. The sum of the decayed, missing and filled teeth was the DMFT index (17).

(3) Visual Plaque Index (VPI) (18): an adaptation of the VPI was used to assess the oral hygiene. The occurrence of

clearly visible plaque on the buccal and lingual surfaces of all remaining teeth was recorded as positive if it was visible beyond doubt by the researcher. The VPI was expressed as a percentage of the positive findings in the total number of examined surfaces.

(4) Salivary flow rate: stimulated salivary flow rate was determined by having participants chew on a piece of parafilm with a 0.02" thickness (Parafilm M®; Bemis Company, Inc., Neenah, WI, USA) for 5 min, expectorating saliva at 30 s intervals into a pre-weighted dish. Salivary flow rate (g/min) was then calculated (19) by subtracting the initial weight from the final weight of the glass; and

(5) Removable prostheses conditions: maxillary and mandibular complete dentures (CD) and/or removable partial dentures (RPD) were evaluated according to Vigild criteria (20). Within the mouth, the maxillary and mandibular prostheses were evaluated for stability, retention, occlusion and vertical height; outside the mouth, they were evaluated for defects, such as wear and/or missing/fractured teeth, broken flanges and loss of pieces of the prosthesis base (20).

### Subjective Assessment

Self-perception of oral health was evaluated using the validated GOHAI (10) Portuguese version (11). A single trained examiner administered the GOHAI, asking participants to respond the 12 items in reference to the last three months using a 3-point scoring scale (always, sometimes or never) (11). The final GOHAI score was calculated as previously described by Atchison and Dolan (10) and could range from 12 to 36. Scores of 34 to 36 were classified as high, scores of 31 to 33 as moderate and scores less than 30 as low (21). Higher GOHAI scores indicate more positive perceptions of oral health and lower GOHAI scores are associated with more self-reported oral health problems and poorer oral health conditions (10).

### Statistical Analysis

Data were evaluated using SAS 9.3 (SAS Institute Inc., SAS Campus Drive, Cary, NC, USA). Exploratory analysis using the Shapiro-Wilk test showed that data were normally distributed. T-tests were used to analyze age, educational level, monthly income and prosthesis age, as well as the number of remaining teeth, DMFT, VPI, salivary flow rate, and subjective data from the GOHAI. Squared chi tests were used to analyze the type and condition of maxillary and mandibular removable dental prostheses. All statistical analyses were carried out at a 5% significance level.

## Results

As shown in Table 1, sociodemographic and prosthesis characteristics of PD patients and controls were similar

( $p > 0.05$ ). Both groups had few remaining teeth, high DMFT, high VPI and normal salivary flow rate ( $> 0.70$  g/mL) ( $p > 0.05$ ) (Table 2). Still about DMFT, results showed no differences between groups for the decayed ( $p = 0.876$ ), missing ( $p = 0.422$ ) and filled teeth ( $p = 0.284$ ), with mean number of  $0.24 \pm 0.75$  decayed,  $22.18 \pm 6.30$  missing and  $2.41 \pm 3.45$  filled teeth for PD group; and  $0.20 \pm 0.62$  decayed,  $25.40 \pm 4.52$  missing and  $1.25 \pm 2.77$  filled teeth for controls. GOHAI scores showed a group difference: controls had moderate scores and PD patients had low scores, indicating more self-reported oral health issues in

PD subjects ( $p = 0.04$ ) (Table 2). Group differences were also observed in the maxillary prostheses, which had greater defects in the control group ( $p < 0.05$ ), as shown in Table 3. The most common defects observed were worn artificial teeth and missing/fractured teeth.

## Discussion

This cross-sectional study on oral health of elders with PD revealed similar numbers of remaining teeth, DMFT and VPI between the PD and control subjects. Interestingly, PD elders had more negative self-perceptions about their oral health, despite having fewer defects in the maxillary prostheses than the controls.

PD and control subjects had similar age, educational level, monthly income and prosthesis characteristics. Both

Table 1. Sociodemographic and removable prostheses characteristics of PD patients and controls

Characteristic	PD (n=17)	Control (n=20)	p
Age (years)	69.41 ( $\pm 4.65$ )	72.00 ( $\pm 5.69$ )	0.186
Educational level (years)	7.94 ( $\pm 5.66$ )	4.48 ( $\pm 3.50$ )	0.064
Monthly income (BRL)	2.84 ( $\pm 1.29$ )	2.65 ( $\pm 2.31$ )	0.839
Edentulous	7 (41.18)	14 (70.00)	0.078
Partially dentate	10 (58.82)	6 (30.00)	0.078
Maxillary prostheses	17 (100.00)	20 (100.00)	
CD	11 (64.70)	18 (90.00)	0.063
RPD	6 (35.30)	2 (10.00)	0.063
Mandibular prostheses	9 (52.94)	17 (85.00)	
CD	6 (66.67)	13 (76.47)	0.072
RPD	3 (33.33)	4 (23.53)	0.855
Prosthesis age (years)			
Maxillary	9.44 ( $\pm 10.25$ )	12.71 ( $\pm 13.84$ )	0.525
Mandibular	7.94 ( $\pm 6.52$ )	11.78 ( $\pm 11.18$ )	0.595

Data represent mean ( $\pm$  standard deviation) or frequency (%). BRL: minimum wage in Brazilian reals; PD: Parkinson's disease; CD: complete denture; RPD: removable partial denture.

Table 2. Number of remaining teeth, DMFT, VPI, salivary flow rate, and GOHAI in PD patients and controls

Parameter	PD (n=17)	Control (n=20)	p
Number of teeth	10.00 ( $\pm 5.23$ )	8.66 ( $\pm 3.83$ )	0.597
DMFT	24.82 ( $\pm 3.76$ )	26.85 ( $\pm 2.18$ )	0.111
VPI	91.76 ( $\pm 16.86$ )	64.10 ( $\pm 48.91$ )	0.231
Salivary flow rate (g/min)	0.78 (0.56)	1.00 (0.70)	0.312
GOHAI	27.35 ( $\pm 4.23$ )	30.50 ( $\pm 4.65$ )	0.040

Data represent mean ( $\pm$  standard deviation). DMFT: Decayed, missing and filled teeth. PD: Parkinson's disease; VPI: Visual Plaque Index; GOHAI: General Oral Health Assessment Index.

Table 3. Removable prosthesis conditions for the upper and lower prosthesis of PD patients and controls

Parameter	PD (n=17)	Control (n=20)	P
Stability of maxillary prostheses			0.054
Satisfactory	15 (88.24)	12 (60.00)	
Unsatisfactory	2 (11.76)	8 (40.00)	
Stability of mandibular prostheses			0.700
Satisfactory	4 (36.36)	5 (29.41)	
Unsatisfactory	7 (63.64)	12 (70.59)	
Retention of maxillary prostheses			0.985
Satisfactory	11 (64.71)	13 (65.00)	
Unsatisfactory	6 (35.29)	7 (35.00)	
Retention of mandibular prostheses			0.463
Satisfactory	4 (36.36)	4 (23.53)	
Unsatisfactory	7 (63.64)	13 (76.47)	
Occlusion			0.911
Satisfactory	2 (33.33)	4 (30.77)	
Unsatisfactory	4 (66.67)	9 (69.23)	
Vertical height			0.252
Acceptable	4 (66.67)	5 (38.46)	
Low	2 (33.33)	8 (61.54)	
Defects of maxillary prostheses			0.037
Absent	10 (58.82)	5 (25.00)	
Present	7 (41.18)	15 (75.00)	
Defects of mandibular prostheses			0.184
Absent	6 (54.55)	5 (29.41)	
Present	5 (45.45)	12 (70.59)	

Data represent frequency (%). PD: Parkinson's disease.

groups had few remaining teeth; no group difference was observed. This result may be influenced by the sample characteristics, which included edentulous and partially edentulous elders in both groups. Previous studies also found similar numbers of teeth between PD subjects and controls (14) and those authors reported that problems such as missing teeth become more marked only in advanced PD stages. In contrast, Nakayama et al. (13) and Hanaoka and Kashihara (22) found few teeth in PD patients than in controls and reported that caries and periodontal disease are frequent complications in this population. Since greater severity of PD predisposes individuals to a poorer state of oral health (5), these contrasting results may be due to inclusion of patients with different degrees of PD severity (13,22), which was not recorded in the present study.

As regards DMFT, no difference was observed between groups in the total DMFT, as well as in their components (decayed, missing and filled teeth), demonstrating the same need for caries treatment in PD and control participants. Previous studies also found similar DMFT values for PD and control subjects (23). In contradiction, some authors (6,7) found different total DMFT values in the PD group than in controls. Fukayo et al. (6) verified lower DMFT in PD patients, because they maintained a better routine of oral hygiene than the control ones. Petersen et al. (7) found higher DMFT in PD subjects, probably due to the greater number of missing teeth in their PD subjects, which may explain the difference in results.

In the present study, VPI values were similar between groups and all participants were considered to have high VPI, which represents poor oral hygiene. Fukayo et al. (6) observed more frequent tooth brushing and better oral health in PD outpatients with mild symptoms than in controls. However, they also reported that when some of the caries-associated environments were particularly poor in both PD and control patients, the oral health status between them did not differ (6), which agrees with the present results. On the other hand, Bakke et al. (14) reported that dental plaque, food debris and periodontal health are probably more marked in patients with advanced PD, and Müller et al. (5) reported that younger and hospitalized PD patients had poorer plaque index compared to controls. Those authors (5) did not consider motor fluctuations during evaluations, which may influence their results and support explaining the study's contrasting data.

In addition to the fact that PD subjects were able to perform their own oral hygiene in the current study, the salivary flow rate could also help to explain the similarity of VPI values between groups. Salivary flow rate plays an important role in the buffering capacity of the saliva (23), which is essential to maintain oral health due to its protective functions, including flushing plaque and

bacteria from mucosal and dental surfaces in the mouth (5). Although PD participants in the current study were receiving levodopa, which may reduce salivary secretion (6), no difference in salivary flow rate was observed between the PD and control elders. Thus, similar levels of salivary protective functions in PD and control elders could have influenced the VPI observed in both groups in the current study.

Removable prosthesis conditions showed group differences only in defects of the maxillary prostheses, which were greater in the controls. These defects were mainly due to wear of artificial teeth and missing/fractured teeth. Although no previous studies have evaluated prosthesis conditions in PD patients, Bakke et al. (14) reported impaired masticatory performance in PD patients. Thus, the authors of this study hypothesize that the higher frequency of artificial tooth wear and consequently the greater defects of the maxillary prostheses observed in controls of the current study, which was due to their better masticatory ability and greater wear of artificial teeth as consequence.

The GOHAI index showed that PD participants had a more negative self-perception of their oral health than controls, indicating more self-reported oral health issues. This finding supports previous reports (9,15), despite the use of different methodologies for this subjective evaluation. Since the PD and control participants in this study had the same need for dental treatment, as observed in the DMFT results, the PD symptoms may contribute for the GOHAI results. PD tremors and rigidity can affect the orofacial musculature, and they may also induce orofacial pain, cracked teeth dental attrition (24) and could probably create difficulties in controlling and retaining dentures (25). Thus, the motor symptoms of PD may explain the more negative self-perceptions of oral health in these patients.

The GOHAI usually requires a larger sample size than the current study, which could be considered a limitation. However, standardizing by age, educational level and monthly income improved the study's confidence levels. Another potential limitation is that oral health parameters deteriorate as PD progresses (5) and PD patients in the current study were not stratified by disease severity (2). However, the PD volunteers had a mean of 6.76 years since PD diagnosis and all of them were able to attend clinical care sessions and perform their own oral hygiene. This suggests that the PD subjects in the present study were not in the advanced PD stage.

In conclusion, the present study showed that elderly individuals with PD have similar oral health as elderly individuals without the disease. Although all elders showed few remaining teeth, high DMFT and high VPI, those with PD had more negative self-perceptions of their oral health.

## Resumo

Este estudo teve como objetivo avaliar objetiva e subjetivamente a saúde bucal em idosos com doença de Parkinson (DP), usando avaliações clínicas bucais e do General Oral Health Assessment Index (GOHAI). Os participantes foram 37 indivíduos usuários de prótese removível, 17 com DP (idade média 69,59±5,09 anos) e 20 sem DP (idade média 72,00±5,69 anos). A avaliação objetiva incluiu avaliação de características bucais, incluindo número de dentes remanescentes; dentes cariados, perdidos e obturados (CPOD); índice de placa visível (IPV), a taxa de fluxo salivar e as condições das próteses removíveis. A avaliação subjetiva incluiu autopercepção da saúde bucal, coletada usando o índice GOHAI. O número de dentes remanescentes, CPOD, IPV, fluxo salivar e os dados GOHAI foram comparadas entre os grupos utilizando o teste *t*. As condições das próteses removíveis foram analisadas utilizando o teste  $\chi^2$  ( $p < 0,05$ ). Não houve diferenças entre os grupos no número de dentes remanescentes, CPOD, IPV ou fluxo salivar ( $p > 0,05$ ). Maiores defeitos na prótese superior foi observada no grupo controle ( $p = 0,037$ ). As pontuações do GOHAI foram baixa para o grupo DP e moderada para os controles, com diferença entre os grupos ( $p = 0,04$ ). Como conclusão, os idosos com doença de Parkinson tem saúde bucal semelhante aos controles. Embora todos os idosos tenham poucos dentes remanescentes, alto CPOD e alto IPV, os idosos com DP apresentaram autopercepção mais negativa da sua saúde bucal em relação aos controles.

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