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Oral health conditions, behavior and swallowing in patients with Parkinson's disease

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Abstract

Background: The symptoms of Parkinson's disease (PD) can lead to problems in maintaining oral health and an inability to swallow which can then negatively affect the patient's quality of life. The purpose of the present study was to investigate oral health conditions, oral health behavior and swallowing among patients with PD in Japan.

Methods: We investigated 200 Parkinsonism patients in the east Iburi area of Hokkaido, Japan by mail. From 108 respondents, we used 100 PD patients over 60 years of age as cases. Dental examinations for Parkinsonism patients were not conducted. One thousand and thirty-four persons over 20 years of age underwent dental examinations conducted by the municipalities in the Tokachi area of Hokkaido. We selected 708 persons over 60 years of age as control. A structured questionnaire was employed for both cases and controls. We compared oral health conditions and related factors between 100 PD patients and 708 controls. The logistic regression model was used for adjusting for sex and age. We also conducted stratified analysis by sex while adjusting for age using this model.

Results: (1) Compared with the controls, PD patients had more complaints of chewing difficulties, toothache, gingival bleeding, bad breath, sliminess of the mouth, annoying teeth alignment, food impaction, swollen gums or mucosa and denture discomfort. (2) Fewer PD patients had their own teeth regardless of sex. (3) More PD patients used a fluoride toothpaste than controls, regardless of sex. (4) PD patients performed daily tooth-brushing or denture cleaning more frequently than the controls. (5) Among PD patients, 55.6% had problems with swallowing.

Conclusion: We found that PD patients had more complaints about oral health and troubles with swallowing. It would be important for public health center to conduct dental checkups and professional oral care through home visits for PD patients.

keywords: Oral health, Parkinson disease, Parkinsonism, Dysphagia

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I. Introduction

Parkinson's disease (PD) is a progressive, disabling neurodegenerative disorder that is characterized by tremor, bradykinesia, muscle rigidity, postural instability and gait disturbance [1]. In addition, there are no established medical treatments to completely cure PD because their etiologies remain largely unknown. These symptoms can lead to problems in maintaining oral health

and an inability to swallow which can then negatively affect the patient's quality of life. In the elderly with dysphagia, dental disease and/or poor oral hygiene have been shown to have a high incidence of aspiration pneumonia [2, 3], which often lead to death in patients with PD [4, 5]. Therefore, it is important for patients with PD to maintain good oral hygiene.

However, their dental status is ultimately unknown. Persson et al. [6] reported that in PD patients, there was

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large number of remaining teeth, and the decayed tooth count was lower compared with controls. On the other hand, several studies outside Japan reported that the dental status of the PD patients was poorer than that of the controls [7-9]. As far as we know, there were three surveys of the dental status of PD patients in Japan [3, 10, 11]. Fukayo et al. [10] reported that the oral health of PD outpatients with mild symptoms was better than the controls. Hanaoka et al. [11] reported patients with PD had fewer remaining teeth, more caries and a higher incidence of deep periodontal pockets. In our investigation of the oral health conditions of PD patients in the Okhotsk area of Hokkaido Prefecture in 2000, patients with PD had more complaints and fewer remaining teeth than the controls [3]. Accordingly, the findings in Japan were not the same regarding the dental status of PD patients [3, 10, 11].

We thought that the symptoms of PD patients made it difficult for the patients to perform daily oral hygiene. PD patients may be a higher-risk group for caries, periodontal disease and swallowing dysfunction than the general population. The purpose of the present study was to investigate the oral health conditions, oral health behaviors and swallowing abilities of patients with PD in Japan.

II. Methods

1. Subjects

The design of this study is a case-control study analyzing PD patients as cases and members of the general population as control.

In Japan, patients with Parkinsonism can receive public financial aid from the government if their disease stage according to Hoehn and Yahr, is from III to V. The eligible study cases that participated in this research were all drawn from the 200 patients with Parkinsonism who had received public financial aid in the east Iburi area in 2013. East Iburi is located in the central part of Hokkaido, the northernmost island of Japan. One hundred and eight Parkinsonism patients responded (response rate: 54%). The case group of 108 patients of Parkinsonism is comprised of 105 with Parkinson's disease, one with corticobasal degeneration and two with an undetermined

diagnosis. We used 100 PD patients over 60 years of age as cases. Forty-eight patients (48.0%) were in stage III (male: 17 patients, female: 31 patients), 24 patients (24.0%) in stage IV (male: 12 patients, female: 12 patients), 27 patients (27.0%) in stage V (male: 6 patients, female: 21 patients) of the Hoehn & Yahr disability stages. The mean of the stages was 3.79 (standard deviation [SD] 0.84).

From June 2010 to March 2011, 1034 persons (457 males, 577 females) over 20 years of age underwent dental examinations conducted by the municipalities of Obihiro city and Honbetsu town in the Tokachi area, located in the eastern part of Hokkaido. We selected 708 persons over 60 years of age as controls. The population and population aging rate of the principal city (Tomakomai city: 23.2%) in the east Iburi area are similar to that of Obihiro city (24.3%), the principal city of the Tokachi area [12]. The distribution of the age and sex in the 100 cases with PD and 708 controls are shown in Table 1. The mean age of the 100 cases was 74.5 (SD 8.0); there were 35 men (mean age 75.8, SD 5.8 years) and 65 women (mean age 73.8, SD 8.9). The mean age of the 708 controls was 71.0 (SD 6.9); there were 310 men (mean age 71.7, SD 6.7) and 398 women (mean age 70.5, SD 7.0). Written informed consent was obtained from all participants. This survey was approved by the Ethical Committee of Sapporo Medical University on May 24, 2013.

2. Method of survey

During the period spanning from June through September in 2013, we investigated the patients with Parkinsonism by mail. A structured questionnaire was employed for both patients and controls. Common questions in the survey for patients and controls inquired about dental status, oral complaints and oral health behavior. Question items for all cases and controls included wearing dentures, bad breath, sliminess of the mouth, chewing difficulties, swollen gums or mucosa, pain of the jaw, having a dental examination regularly, the presence of a family dentist, and smoking history. Individuals who still had their own teeth were asked about toothache, gingival bleeding, annoying teeth alignment, food impaction, tooth movement, tooth brushing, and whether they were using a fluoride toothpaste, an interdental brush or dental floss. Those for individuals

Table 1 Sex and age distribution of 100 Parkinson's disease patients and 708 controls.

	Parkinson's disease			control		
	male n(%)	female n(%)	total n(%)	male n(%)	female n(%)	total n(%)
age (year)						
60-69	5 (14.3)	26 (40.0)	31 (31.0)	132 (42.6)	193 (48.5)	325 (45.9)
70-79	18 (51.4)	21 (32.3)	39 (39.0)	139 (44.8)	163 (41.0)	302 (42.7)
80+	12 (34.3)	18 (27.7)	30 (30.0)	39 (12.6)	42 (10.6)	81 (11.4)
total	35 (100)	65 (100)	100 (100)	310 (100)	398 (100)	708 (100)

with dentures involved denture discomfort, cleaning dentures, and storing their dentures correctly before sleeping. In addition, the presence of their own teeth and troubles with swallowing (spilling one's food from the mouth, choking on food or beverage, coughing during eating or drinking, always making a noise with the throat, taking a long time to swallow) were surveyed among the Parkinsonism patients. Dentists from the dental clinics in Obihiro city and Honbetu town examined the teeth of the 1034 controls. The dental examinations were conducted by a trained dentist at a local dental clinic under sufficient artificial light, with dental mirrors, and explorers. The contents of the dental examination were the diagnoses of dental caries (sound teeth, filled teeth, decayed teeth and missing teeth). For the survey of 1034 controls, public health nurses in Honbetsu town or dental hygienists from a dental clinic in Obihiro city interviewed the subjects with a structured questionnaire on the day of the dental examination. Dental examinations were not conducted for the Parkinsonism patients.

3. Analyses

We used the logistic regression model adjusted for sex

and age to assess the difference between the case group and the control group by oral complaints, oral health behaviors and dental status. The adjusted odds ratio (OR) and its 95% confidence interval (CI) for oral health in PD patients were estimated. We also conducted stratified analysis by sex using this model. Tests of statistical significance were based on a two-sided p-value, and the α -error was set at 5%. The SAS system (ver.9.4; SAS Institute, Cary, NC, USA) was employed for the analysis.

III. Results

1. Results from a case-control study

Table 2 shows the results from the logistic regression analyses of oral health in PD patients, adjusted for sex and age, in males and females after adjusting for age.

i) Dental status

As shown in Table 2, individuals without their own teeth were more commonly found among the PD patients than in the control group (OR 4.56; 95%CI, 2.16-9.65). PD patients more commonly lacked their own teeth than the controls in both males and females (male: OR 9.92; 95%CI, 2.43-40.39; female: OR 3.64; 95%CI, 1.49-8.90).

Table 2 Results of logistic regression analysis of oral health conditions in 100 Parkinson's disease patients and 708 controls

			adjusted for sex, age			by sex adjusted for age					
	cases n	controls n	cases n(%)	controls n(%)	odds ratio (95%CI)	male			female		
						cases n(%)	controls n(%)	odds ratio (95%CI)	cases n(%)	controls n(%)	odds ratio (95%CI)
Dental status											
No own teeth	100	708	16(16.0)	19(2.7)	4.56(2.16-9.65)*	5 (14.3)	4 (1.3)	9.92(2.43-40.39)*	11(16.9)	15(3.8)	3.64(1.49-8.90)*
Wearing dentures	100	700 [§]	57(57.0)	452(64.6)	0.55(0.35-0.87)*	21(60.0)	193(63.1)	0.63(0.29-1.35)	36(55.4)	259(65.7)	0.51(0.29-0.89)*
Oral complaints											
Toothache	84 [†]	689 [†]	22(26.2)	72(10.5)	3.23(1.86-5.61)*	7 (23.3)	38(12.4)	2.43(0.95-6.21)	15(27.8)	34(8.9)	3.96(1.98-7.91)*
Gingival bleeding	84 [†]	689 [†]	19(22.6)	35(5.1)	6.04(3.22-11.36)*	6 (20.0)	12(3.9)	6.88(2.28-20.78)*	13(24.1)	23(6.0)	5.49(2.54-11.86)*
Bad breath	99 [§]	708	26(26.3)	38(5.4)	9.21(5.03-16.85)*	11(32.4)	19(6.1)	9.36(3.74-23.39)*	15(23.1)	19(4.8)	9.03(4.02-20.27)*
Sliminess of the mouth	99 [§]	708	40(40.4)	40(5.7)	12.50(7.29-21.43)*	16(47.1)	16(5.2)	21.24(8.46-53.30)*	24(36.9)	24(6.0)	9.46(4.84-18.51)*
Chewing difficulties	99 [§]	708	23(23.2)	55(7.8)	3.61(2.06-6.31)*	7 (20.6)	28(9.0)	2.42(0.93-6.29)	16(24.6)	27(6.8)	4.51(2.24-9.09)*
Annoying teeth alignment	84 [†]	689 [†]	19(22.6)	37(5.4)	5.01(2.71-9.29)*	8 (26.7)	11(3.6)	9.84(3.46-28.01)*	11(20.4)	26(6.8)	3.51(1.62-7.62)*
Food impaction	84 [†]	689 [†]	53(63.1)	143(20.8)	6.72(4.13-10.92)*	21(70.0)	64(20.9)	8.20(3.56-18.92)*	32(59.3)	79(20.6)	5.86(3.20-10.72)*
Swollen gums or mucosa	99 [§]	708	21(21.2)	78(11.0)	2.57(1.47-4.47)*	6 (17.7)	45(14.5)	1.29(0.50-3.34)	15(23.1)	33(8.3)	4.00(1.98-8.11)*
Tooth movement	84 [†]	689 [†]	11(13.1)	54(7.8)	1.81(0.90-3.63)	4 (13.3)	25(8.2)	1.73(0.55-5.46)	7 (13.0)	29(7.6)	1.84(0.76-4.43)
Denture discomfort	57 [‡]	452 [‡]	24(42.1)	67(14.8)	3.92(2.15-7.16)*	6 (28.6)	30(15.5)	2.09(0.74-6.00)	18(50.0)	37(14.3)	5.63(2.64-11.99)*
Pain of the jaw	99 [§]	708	2 (2.0)	11(1.6)	1.08(0.23-5.13)	0 (0)	5 (1.6)	-	2 (3.1)	6 (1.5)	1.67(0.32-8.70)
Oral health behavior											
Brushing teeth less than once a day	84 [†]	658 [§]	17(20.2)	205(31.2)	0.56(0.32-0.99)*	6 (20.0)	128(43.1)	0.31(0.12-0.78)*	11(20.4)	77(21.3)	0.89(0.44-1.83)
Cleaning denture less than once a day	57 [‡]	434 [§]	14(24.6)	172(39.6)	0.49(0.26-0.95)*	5 (23.8)	104(53.3)	0.27(0.10-0.79)*	9 (25.0)	68(28.5)	0.76(0.33-1.73)
Not removing dentures and putting them in a cup of water when sleeping	57 [‡]	433 [§]	14(24.6)	119(27.5)	0.83(0.43-1.61)	8 (38.1)	62(32.3)	1.18(0.46-3.07)	6 (16.7)	57(23.7)	0.61(0.24-1.56)
Using a fluoride toothpaste	84 [†]	674 [§]	57(67.9)	272(40.4)	2.99(1.84-4.86)*	20(66.7)	108(35.9)	3.25(1.46-7.26)*	37(68.5)	164(44.0)	2.77(1.51-5.10)*
Not using an interdental brush	84 [†]	674 [§]	54(64.3)	459(68.1)	0.85(0.52-1.38)	20(66.7)	239(79.4)	0.51(0.22-1.16)	34(63.0)	220(59.0)	1.13(0.62-2.06)
Not using a dental floss	84 [†]	674 [§]	77(91.7)	618(91.7)	1.00(0.44-2.29)	29(96.7)	284(94.4)	1.70(0.22-13.44)	48(88.9)	334(89.5)	0.90(0.36-2.25)
Not having a dental examination regularly	100	657 [§]	44(44.0)	313(47.6)	0.85(0.55-1.30)	11(31.4)	136(46.9)	0.60(0.28-1.29)	33(50.8)	177(48.2)	1.04(0.61-1.78)
Not having own family dentists	100	708	19(19.0)	108(15.3)	1.32(0.76-2.29)	4 (11.4)	51(16.5)	0.80(0.27-2.42)	15(23.1)	57(14.3)	1.70(0.88-3.27)
Having a history of smoking	100	708	17(17.0)	192(27.1)	0.64(0.37-1.13)	14(40.0)	120(38.7)	1.25(0.60-2.60)	3 (4.6)	72(18.1)	0.23(0.07-0.74)*

CI: confidence interval

- : not calculated

*: p<0.05

†: Having own teeth

‡: Using dentures

§: Excluding missing value

b: Excluding those without own teeth and missing value

¶: Excluding those not using dentures and missing value

Individual wearing dentures were less commonly seen among PD patients than the controls (OR 0.55; 95%CI, 0.35-0.87). Fewer female PD patients wore dentures than female controls (OR 0.51; 95%CI, 0.29-0.89).

ii) Oral complaints

More PD patients complained of toothache (OR 3.23; 95%CI, 1.86-5.61), chewing difficulties (OR 3.61; 95%CI, 2.06-6.31), swollen gums or mucosa (OR 2.57; 95%CI, 1.47-4.47) and denture discomfort (OR 3.92; 95%CI, 2.15-7.16) than controls, and more female PD patients complained of them than female controls.

More PD patients complained of gingival bleeding (OR 6.04; 95%CI, 3.22-11.36), bad breath (OR 9.21; 95%CI, 5.03-16.85), sliminess of the mouth (OR 12.50; 95%CI, 7.29-21.43), annoying teeth alignment (OR 5.01; 95%CI, 2.71-9.29) and food impaction (OR 6.72; 95%CI, 4.13-10.92) than controls, and more PD patients complained of them than both male and female controls.

iii) Oral health behavior

Fewer PD patients brushed their teeth (OR 0.56; 95%CI, 0.32-0.99) or cleaned their dentures (OR 0.49; 95%CI, 0.26-0.95) less than once a day than controls, and fewer male PD patients brushed their teeth and cleaned their dentures less than once a day than male controls.

More PD patients used a fluoride toothpaste than controls (OR 2.99; 95%CI, 1.84-4.86), and more PD patients used a fluoride toothpaste than both male and female controls (male: OR 3.25; 95%CI, 1.46-7.26, female: OR 2.77; 95%CI, 1.51-5.10).

Fewer female PD patients had a history of smoking than female controls (OR 0.23; 95%CI, 0.07-0.74).

2. Complaints of swallowing among PD patients

Table 3 shows the complaints of swallowing among

the 100 PD patients. As for swallowing, 55 (55.6%) PD patients answered that they had some problems. By multiple answer, over 25% of PD patients complained of the following: spilling one's food from the mouth (25.3%), choking on food (28.3%), choking on beverage (27.3%).

IV. Discussion

1. The oral health conditions of 100 PD patients

In the present study, PD patients had more oral complaints compared to the controls. We found that many PD patients had symptoms such as caries and periodontal disease. Some previous studies [8, 9, 11, 13] reported PD patients had more caries or instances of periodontal disease compared to the controls. This may be explained by the following reasons. First, PD patients may be suffering from xerostomia [1, 4, 14, 15] or nausea [15,16] caused by the administration of antiparkinsonian medications such as anticholinergics and levodopa. Saliva acts to neutralize and dilute acids formed by dental plaque from ingested carbohydrates. Patients with xerostomia are more likely to develop caries and periodontal disease and nausea causes a decrease in oral hygiene. Second, Kennedy et al. [17] reported that *S. mutans* as cariogenic bacteria, does show a significantly higher percentage in the PD group compared to the control group. Thirdly, PD patients have demonstrated diminished manual dexterity, which limits their ability to carry out the effective removal of plaque [4].

In this study, those who complained of chewing difficulties and denture discomfort were more commonly among the PD patients than the controls, female patients in particular. This showed a similar finding to our investigation [3] in the Okhotsk area of Hokkaido in 2000.

Table 3 Troubles of swallowing among 100 Parkinson's disease patients.

	n(%)*	n(%)**
No problem		43(43.4%)
Swallowing problems		55(55.6%)
Details of swallowing problems(multiple answer);		
Spilling one's food from the mouth	25(25.3%)	
Choking on food	28(28.3%)	
Choking on beverage	27(27.3%)	
Coughing during eating or drinking	19(19.2%)	
Always making a noise with the throat	5 (5.1%)	
Taking a long time to swallow	20(20.2%)	
Gastrostoma		1 (1.0%)
Total#		99(100%)

#: Excluding missing value

*: n(%) for details of swallowing problem (multiple answers)

** : n(%) for no problem, swallowing problems and gastrostoma

Bakke et al. [18] reported that mastication and orofacial functions are impaired in moderate and advanced PD (Hoehn & Yahr stages II-IV). This may be explained by the following reasons. First, PD patients may be suffering from mastication disorders with oral dyskinesia or xerostomia as a side-effect from using levodopa [1, 3, 19, 20]. The tongue may dislodge the mandibular denture, and facial muscles that are rigid or uncontrollable may prevent a maxillary denture from maintaining a retentive seal [4]. Saliva plays the role of adhesive for wearing dentures. Xerostomia cause dentures to drop off the mucosa or become unstable. Second, tremors and rigidity of the orofacial musculature may create difficulties in controlling and retaining dentures [1, 14], or difficulties in chewing. Thirdly, PD patients have a slowness in their chewing due to bradykinesia [1].

Many females, but not so many males, PD patients complained of denture discomfort and chewing difficulties. Female PD patients might suffer from denture discomfort or chewing difficulties caused by involuntary movements of the facial muscles, tongue and lips, as oral dyskinesia is more commonly seen in elderly women than in elderly men [2].

The present study showed that many PD patients did not have their own teeth, regardless of sex. This showed a similar finding to our investigation [3] in the Okhotsk area of Hokkaido in 2000. Einarsdóttir et al. [7] reported that subjects with PD had significantly more missing teeth than the comparison group. Cicciú et al. [8] reported that the frequency of missing teeth in PD patients was significantly higher than in the control group. However, Persson et al. [6] reported that PD patients had more remaining teeth than controls. Many PD patients in the present study may be more likely to be suffering from dental caries and periodontal disease according to their complaints. Aida et al. [21] reported that most of the permanent teeth were extracted due to caries and periodontal disease in Japan. In addition, gait disturbances and postural instability accentuated by the symptoms of PD may have increased the difficulty experienced by patients when going to a dental clinic during the early stage of caries.

In this study, we found that more PD patients suffer from swollen gums or mucosa than controls after adjusting for sex and age. Xerostomia caused by the use of antiparkinsonian medications is a possible cause. Saliva involves mucin, which functions as a lubricating action and also protects the mucosal epithelia of oral the cavity. Kennedy et al. [17] reported that PD patients showed a significant increase in mucositis compared with the control groups.

2. Swallowing conditions

Fifty-five (male: 24 patients, female: 31 patients) of the

99 (55.6%) PD patients had self-perceived swallowing problem. This showed a similar finding to our investigation [3] in the Okhotsk area of Hokkaido in 2000. Clifford et al. [22] reported that 48% of PD patients had dysphagia. Melo et al. [23] reported that a recent systematic review showed that PD patients are three times more likely than normal controls to develop oropharyngeal dysphagia. However, we may have underestimated the proportion of PD patients with dysphagia in the present study because of the following reasons. First, swallowing dysfunction occurs from the onset of the earliest stages of Parkinson's disease, even in asymptomatic cases [24, 25]. Second, Nilsson et al. [24] found dysphagia in more than 90% of PD patients who were in the same stages as our study subjects (Hoehn and Yahr stages III and IV). The reasons for why many PD patients have dysphagia may be xerostomia [1, 4, 14, 15, 26] caused by the administration of antiparkinsonian medications such as anticholinergics and levodopa, the dementia most PD patients display [1, 27], various motor disorders such as hypokinesia, akinesia and so on [28], a side effect of using levodopa [1, 4, 14, 29] or poor denture control [22].

3. Oral health behavior of PD patients

In this study, more PD patients brushed their teeth or cleaned their own dentures more than twice a day than the controls. Fukayo et al. [10] reported that the frequency of tooth-brushing was higher among PD patients. On the other hand, in our 2000 investigation [3] in the Okhotsk area of Hokkaido, fewer PD patients brushed their teeth or cleaned their own dentures every day than those in the control group. Müller et al. [9] reported that PD patients had lower frequencies of daily tooth-brushing than the controls. As PD patients of this study had more oral complaints than the controls, PD patients would consciously brush their teeth or clean their dentures to reduce their symptoms.

In this study, more PD patients used a fluoride toothpaste than the controls. As more PD patients had symptoms, such as caries, than the controls, PD patients would consciously use a fluoride toothpaste to prevent caries.

There are some limitations to our study. First, we did not check the duration of the disorder. There is the possibility of a survival bias, because we used not only incident cases, but also prevalent cases. Cereda et al. [27] reported that swallowing disturbances were significantly associated with a longer disease duration. Second, the controls were not randomly selected from the general population. The participants in this study were those who were interested a dental examinations conducted by the municipality, possibly causing a response bias. Thirdly, in this study, the area the PD subjects were living in was

different from that of the controls. However, the population and population aging rate of the principal city (Tomakomai city) of the east Iburi area are similar to those of Obihiro city as principal city of the Tokachi area. Fourth, because public financial aid included every patient with Parkinsonism, we recruited all of them for the survey. However, we confined the analysis to PD patients in order to refine the research hypothesis.

In conclusion, we found that PD patients had more complaints about oral health (e.g., toothache, gingival bleeding, chewing difficulties, denture discomfort). In addition, 55.6% of PD patients had problems with swallowing. Moving forward, it would be important that public health center continuously conducts dental checkups and professional oral care through home visits for PD patients. More than ever, it is necessary that clinical dentists understand the oral health conditions and swallowing problems of PD patients.

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パーキンソン病患者の口腔内状況，口腔保健行動及び嚥下の状況

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抄録

背景：パーキンソン病の諸症状は，口腔内状態をより良く保つことを困難にさせたり，嚥下に問題を起こさせたりする。これは，パーキンソン病患者のquality of lifeに影響を与える。今回の研究の目的は，日本のパーキンソン病患者の口腔内状況，口腔保健行動及び嚥下の状況を調査することである。

方法：この研究デザインは，ケースコントロール研究である。調査対象者は，平成25年に，北海道東胆振地域に在住し，特定疾患医療受給者証を所持しているパーキンソン病関連疾患患者200人である。このうち，108人が調査に回答し，60歳以上の100人のパーキンソン病患者をケースとした。コントロールは，平成22年度に北海道十勝地域の市町村で実施した成人歯科健診受診者1034人のうち，60歳以上の708人とした。統計解析は，ロジスティック回帰分析を用い，性・年齢を調整し，オッズ比と95%信頼区間を求め，口腔保健状況をケースとコントロール間で比較した。

結果：(1)健常者に比べて，パーキンソン病患者は，うまく咬めない，歯痛，歯肉出血，口臭，歯並びの悪さ，食片圧入，粘膜腫脹，義歯の不適合等を訴えている者が多かった。(2)パーキンソン病患者は，健常者に比べて歯のない者が多かった。(3)パーキンソン病患者は，健常者に比べて，フッ化物配合歯磨剤を使用する者が多かった。(4)パーキンソン病患者は，健常者に比べて，歯磨き及び義歯の清掃習慣が良かった。(5)パーキンソン病患者の55.6%が，嚥下に問題を抱えていた。

結論：パーキンソン病患者は，口腔内に多くの問題を抱え，嚥下も困難な者が多いことがわかった。保健所は，パーキンソン病患者への訪問を通して，歯科健診及び専門的な口腔ケアを継続していくことが重要である。

キーワード：口腔保健，パーキンソン病，パーキンソン病関連疾患，嚥下障害