Effect of the Yon PD□ on the management of self-care in people with Parkinson's disease: a randomized controlled study

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Abstract

Background: As the percentage of the older population increases, the percentage of people with Parkinson’s disease (PD) also increases. People with PD experience a range of non-motor symptoms, including pain, constipation, dysphagia, sleep disturbances, and fatigue. Because PD is a chronic disease that requires lifelong management, people with PD need to improve their self-care.

Objective: To examine the effectiveness of a mobile application on the management of self-care in people with PD.

Methods: People with PD aged 50 years and older and able to use a smartphone were recruited from a tertiary hospital in South Korea. The intervention group received the Yon PD® mobile app, which monitors and records the non-motor symptoms of PD. The control group was asked to record their non-motor symptoms on a paper questionnaire. The intervention took place over 12 weeks, and the level of self-care was assessed in both groups at baseline, 6 weeks, and 12 weeks.

Results: Although the general characteristics of the two groups were comparable, monitoring non-motor symptoms with the Yon PD® app effectively increased self-care maintenance and prevented a decrease in self-care monitoring. However, self-care management gradually decreased over the 12-week period in both groups. The intervention adherence rate reached 60.84% at 6 weeks but decreased to 41.87% by 12 weeks.

Conclusions: Participants were able to improve the degree of self-care by monitoring their non-motor symptoms using the Yon PD® app. However, additional strategies that increase motivation and enjoyment are required to improve adherence. Clinical Trial: Clinical Research Information Service KCT006433. The first recruitment was conducted in October 2022.

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Abstract

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Objective: To examine the effectiveness of a mobile application on the management of self-care in people with PD.

Design: A randomized controlled study

Setting(s): Participants were recruited from the neurology outpatient clinic of S hospital in South Korea between October 2022 and February 2023.

Participants: In total, 93 participants were included in the analysis. There were 41 and 52 participants in the intervention and control group, respectively.

Methods: People with PD aged 50 years and older and able to use a smartphone were recruited from a tertiary hospital in South Korea. The intervention group received the Yon PD® mobile app, which monitors and records the non-motor symptoms of PD. The control group was asked to record their non-motor symptoms on a paper questionnaire. The intervention took place over 12 weeks, and the level of self-care was assessed in both groups at baseline, 6 weeks, and 12 weeks.

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Registration: Clinical Research Information Service KCT006433. The first recruitment was conducted in October 2022.

Keywords: Parkinson's disease; Non-motor symptoms; Self-care; Mobile application; Randomized controlled trial

1. **Introduction**

Parkinson's disease (PD) is the second most prevalent neurodegenerative disease, commonly occurring after the age of 65 years.[1] In 2020, the number of people with Parkinson's disease (PwP) worldwide was estimated to be 3.4 million, which was 1.5 times higher than in 2016.[2] As the proportion of the older population increases, the proportion of PwP also increases. PD is an incurable disease caused by irreversible neurological damage, and PwP are faced with high medical costs and the need to manage their disease symptoms throughout life.[3,4] The total economic burden of PD in the United States is increasing every year and was estimated at $51.9 billion in 2017.[4] Previous studies have

emphasized the importance of symptom management in PD since job loss, poor quality of life, and lower self-esteem can result from poor daily performance.[5,6]

Over several decades, most researchers have focused on the motor symptoms of PD, such as bradykinesia (slow movement), tremor, rigidity, postural instability, and swallowing problems.[1] Because motor symptoms are clearly observed as the disease progresses, they have been widely used as diagnostic criteria for PD.[3] However, non-motor symptoms have drawn more attention since it was found that the neurodegenerative changes in PD manifest not only as motor symptoms but also as non-motor symptoms.[7] The non-motor symptoms of PD include neurobehavioral changes (e.g., depression, cognitive impairment), autonomic failure (e.g., urinary dysfunction, abnormal blood pressure), sleep disorders (e.g., insomnia, excessive daytime sleeping), sensory impairments (e.g., problems with vision and smell), weight loss, and fatigue.[3,7] Non-motor symptoms can appear throughout the disease trajectory of PD and may even appear before PD is diagnosed.[7] One study found that, on average, PwP experienced seven non-motor symptoms as the disease progressed without realizing that the non-motor symptoms were related to PD.[8]

According to current research, managing non-motor symptoms is as important as managing motor symptoms. Since non-motor symptoms vary among PwP, due to various factors, they are difficult to anticipate and control.[3] In some cases, the non-motor symptoms worsen the motor symptoms by affecting the patient's quality of life.[5,6] Therefore, reducing non-motor symptoms should be considered a major component of the care plan. Because PD is incurable, only symptom management can slow down the disease progression,[9] and effective symptom management relies on enhanced self-care ability. According to Riegel, Jaarsma and Strömberg,[10] self-care consists of three components: self-care maintenance, self-care monitoring, and self-care management. These three components are connected

and work together concurrently. Self-care maintenance refers to behaviors that maintain health. Self-care monitoring refers to observing for symptom changes. Self-care management is the response to any observed symptoms changes.[10]

Current technology has led to the development of numerous mobile applications that assist chronic disease populations with self-care. These mobile applications have been feasible and effective in promoting self-care in people with heart failure, type 2 diabetes, and cancer.[11-13] For PwP, mobile applications to help with medication adherence and to assess motor symptoms have been widely used and studied.[14,15] However, studies on self-care in PwP related to non-motor symptoms are lacking.[16]

To help with the effective self-care of PwP, we developed a mobile application (Yonsei Parkinson's Disease application, Yon PD® app) that can monitor five major non-motor symptoms: pain, constipation, dysphagia, sleep disturbances, and fatigue.[17] The Yon PD® app was a user-friendly app that allowed PwP to easily record non-motor symptoms as well as check medication adherence. Through a 6-week pilot study, the feasibility of the Yon PD® app was confirmed.[18] Based on previous studies, the present study examined whether monitoring non-motor symptoms using the Yon PD® app could improve self-care in people with PD.

2. Methods

2.1. Study design

This was a single-blind randomized controlled study that adopted a nonequivalent control group pretest-posttest design.[19] The participants were randomly assigned to either an intervention or control group using computer-generated random numbers. The generated random numbers were matched in order to the enrolled participants by researchers. If the last digit of the number was even, the participant was assigned to the

intervention group; vice versa, the participant was assigned to the control group. The list of random numbers was stored independently on a password-protected computer. Only authorized researchers were able to access to the list. During the study, researchers did not notice the participants whether they were in the intervention or control group. Thus, only the participants were blinded. A pretest was given to all groups at the beginning of the study and a posttest was given at the end of the study.

2.2. *Study participants and sample size*

Study participants were recruited from the neurology outpatient clinic of S hospital in Seoul, South Korea. Participants were recruited through advertisements and referrals within the hospital from October 2022 to February 2023. Participants were eligible to participate if they were: (a) 50 years old and over; (b) clinically diagnosed with PD by a neurology clinician; (c) able to use a smartphone (e.g., text messaging, using the internet); (d) able to understand the research statement and consent written in Korean; and (e) agreed to participate in this study. Participants were excluded if they: (a) had health problems that could significantly affect the non-motor symptoms of PD; (b) had difficulty manipulating a smartphone due to visual impairment or severe tremor; and (c) had already participated in another intervention study.

The sample size was calculated using the G*Power 3.1 program.[20] The required sample size was 45 for each group with an effect size of 0.6, alpha level of 0.05, and power of 0.6. Considering a 20% dropout rate, the total number of participants was calculated as 108.[21]

2.3. Intervention group

For the intervention group, we provided a mobile application (Yon PD® app) to help monitor the non-motor symptoms of PD. The Yon PD® app was a person-centered navigator program that allowed PwP to monitor their non-motor symptoms.[17] Using the Yon PD® app,

PwP could monitor the presence and severity of pain, constipation, dysphagia, sleep disturbances, and fatigue. The participants were able to record the severity of symptoms by clicking pictures or dragging visual scales. For example, the severity of constipation was recorded by clicking on the corresponding picture of stool. The severity of pain and fatigue were recorded by dragging scores on visual scales. The Yon PD® app could also record medication adherence. However, we did not request medication adherence records so that the PwP could focus on recording non-motor symptoms. The Yon PD® app was downloadable from the online application store for free. The user interface was simple and intuitive; therefore, the Yon PD® app was feasible for PwP of advanced ages.[18]

2.4. Control group

The control group recorded their non-motor symptoms on a paper questionnaire, which contained the same items as the Yon PD® app. Each item was recorded by the intervention group using the Yon PD® app measurement tool, while the control group recorded their non-motor symptoms by hand.

2.5. Study process

Data were collected by two researchers who had been trained prior to data collection to ensure inter-reliability. The collected data included general characteristics, non-motor symptoms of PD, self-care tasks, and satisfaction with the Yon PD® app. Data were collected at baseline, 6 weeks after the intervention, and at the end of the intervention (12 weeks).

We collected baseline data on general characteristics using a self-report questionnaire, and disease information was obtained from the electronic medical records. Participants filled out the self-report questionnaire via paper, online, or by mail according to their preference. Six weeks after the intervention, we collected data on the non-motor symptoms from either the Yon PD® apps (intervention group) or the paper questionnaires

(control group). Based on user opinions collected from the pilot test,[18] we asked the participants to record their pain, constipation, and dysphagia at least twice a week. Sleep disturbances and fatigue were to be recorded at least once a week. Self-care was evaluated using a paper questionnaire in both the intervention and control groups. Data on non-motor symptoms and self-care were collected at 12 weeks in the same manner. In addition, the intervention group evaluated their satisfaction with the Yon PD® app.

For 12 weeks, two researchers checked the use of the Yon PD® app to observe the adherence of the intervention group. Data collected by the Yon PD® app was automatically transmitted to an online system. By observing the online system, researchers were able to check whether the intervention group used the Yon PD® app regularly. If participants in the intervention group did not record anything on the Yon PD® app for a week, researchers called them to encourage use of the app and to check if they were having any difficulties using it. If a participant requested help or information on using the app, researchers provided it immediately.

2.6. Measurement tools

2.6.1. General characteristics

The general characteristics of the participants included sex, age, income, marital status, level of education, presence of a caregiver, living arrangement, employment, disease severity and duration, and the number of comorbidities, which were obtained through a self-report questionnaire. Disease-related information (i.e., disease severity, disease duration, number of comorbidities) was obtained from the electronic medical records.

Disease severity was evaluated by a neurology clinician using the Unified Parkinson's Disease Rating Scale part Ⅲ (UPDRS Ⅲ). The UPDRS Ⅲ includes 31 items to evaluate motor disability, including speech, tremor at rest, rigidity, and posture.[22] The

possible UPDRS Ⅲ scores ranged from 0 to 108. A higher score indicated more severe motor disability. Disease duration was calculated as the number of months from the time PD was diagnosed to the present.

2.6.2. Non-motor symptoms of PD

Five non-motor symptoms commonly reported in PwP were measured: pain, constipation, dysphagia, sleep disturbances, and fatigue.[17] The severity of pain was measured using a combination of the Faces Pain Rating Scale and the visual analogue scale. The possible scores ranged from 0 to 10, and a higher number indicated more severe pain. The participants could record their pain by dragging a slider on the screen with their fingers and by leaving notes about the pain sites. To measure the severity of constipation, participants were asked to record the frequency of defecation and click on a picture corresponding to the stool type. For better understanding, we provided example pictures representing seven types of stool, based on the Bristol Stool Form Scale; the type 1 picture indicated severe constipation and the type 7 picture indicated severe diarrhea.[23]

The degree of dysphagia was measured by clicking on a picture corresponding to the viscosity of food consumed. Example pictures showing three levels of food viscosity were provided based on the Fork Test. Level 1 indicated that the food did not flow off a fork and level 3 indicated that the food could not remain on a fork.[24] Sleep disturbances were measured using the Parkinson's Disease Sleep Scale, which assesses sleep problems (e.g., restlessness, hallucinations) frequently reported in PwP.[25] The scale consisted of 15 items with total scores ranging from 0 to 150. A higher score indicated more severe sleep disturbances. The Parkinson's Disease Fatigue Scale was used to measure the degree of fatigue.[26] Each item was scored from 1 to 5, and the sum of scores on 16 items indicated the degree of fatigue. A higher score meant more severe fatigue.

2.6.3. Self-care

The degree of self-care was measured using the Self-Care of Chronic Illness Inventory (SC-CII).[27] We used the Korean version of SC-CII translated by Dr. Lee with permission from the original author. The Korean version of SC-CII is downloadable from the website (https://self-care-measures.com/project/patient-version-sccii-korean-3-2-2-2/). The SC-CII measures three domains of self-care: self-care maintenance (8 items), self-care monitoring (5 items), and self-care management (7 items). Each item was scored using a 5-point Likert scale (1=never/not likely, 5=always/very likely) with total scores ranging from 0 to 100. In previous studies, a total score of 70 or higher on the SC-CII was reported to indicate a high level of self-care.[27,28] The good validity and reliability of the SC-CII have been reported in previous studies (Riegel et al., 2009). In this study, Cronbach's alpha of the SC-CII was 0.580 ~ 0.673 in maintenance, 0.872 ~ 0.916 in monitoring, and 0.601 ~ 0.725 in management.

2.6.4. Satisfaction with the Yon PD® app

To measure satisfaction with the Yon PD® app, we developed a self-report questionnaire. The questionnaire consisted of 18 items asking about the user's experience with the Yon PD® app. Example questions included "Was the application easy to use?", "Was it easy to find the information you needed in the application?", "Has the application helped you improve your health?", and "Has the application improved access to healthcare service?" Each item was scored using the 7-point Likert scale (1=not likely, 7=very likely). The score totals ranged from 18 to 126, and a higher score indicated a greater satisfaction.

2.7. Ethical considerations

Ethical approval was obtained from the Institute Review Board of the S hospital Human Research Protection Center (IRB no. Y-2020-0220). The S hospital where this study was conducted belongs to the institution that granted ethical approval. Researchers explained the purpose and process of the study to eligible participants and obtained

informed consent from each participant. Participants were guaranteed the right to withdraw, anonymity, and confidentiality of the collected data. All participants were compensated $10 for each data collection. Participants who participated in all three data collection sessions were eligible to receive a total of $30.

2.8. Data analysis

Data analysis was performed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Before the data analysis, missing values and extreme outliers were screened. The listwise deletion method was applied to handle missing values, and extreme outliers were deleted. The normal distribution of continuous data was checked using the Shapiro-Wilk test.

The general characteristics of the participants were analyzed using descriptive statistics, including mean, standard deviation, frequency, and proportion. The homogeneity of two groups at baseline (general characteristics and self-care) was analyzed using the chi-square test, Fisher exact test, and independent t-test with an alpha level of .05. The effect of the intervention on self-care was analyzed using the repeated-measures analysis of variance (ANOVA) with an alpha level of .05. Satisfaction with the intervention was analyzed using mean and standard deviation.

3. Results

3.1. General characteristics

A total of 110 PwP were enrolled in this study. Eight were excluded because they did not meet the inclusion criteria. Of the remaining PwP, 48 were assigned to the intervention group and 54 to the control group. Seven from the intervention group and two from the control group were missing during the follow-up period. A total of 93 PwP were included in the analysis; there were 41 in the intervention group and 52 in the control group (Figure 1). The homogeneity results for general characteristics are presented in Table 1. Between the

two groups, there were no statistically significant differences in sex, age, income, marital status, education level, caregiver presence, living arrangement, employment, disease severity, disease duration, and number of comorbidities. In addition, the degree of self-care at baseline was not statistically different between the two groups.

Figure 1. Flow diagram of enrollment

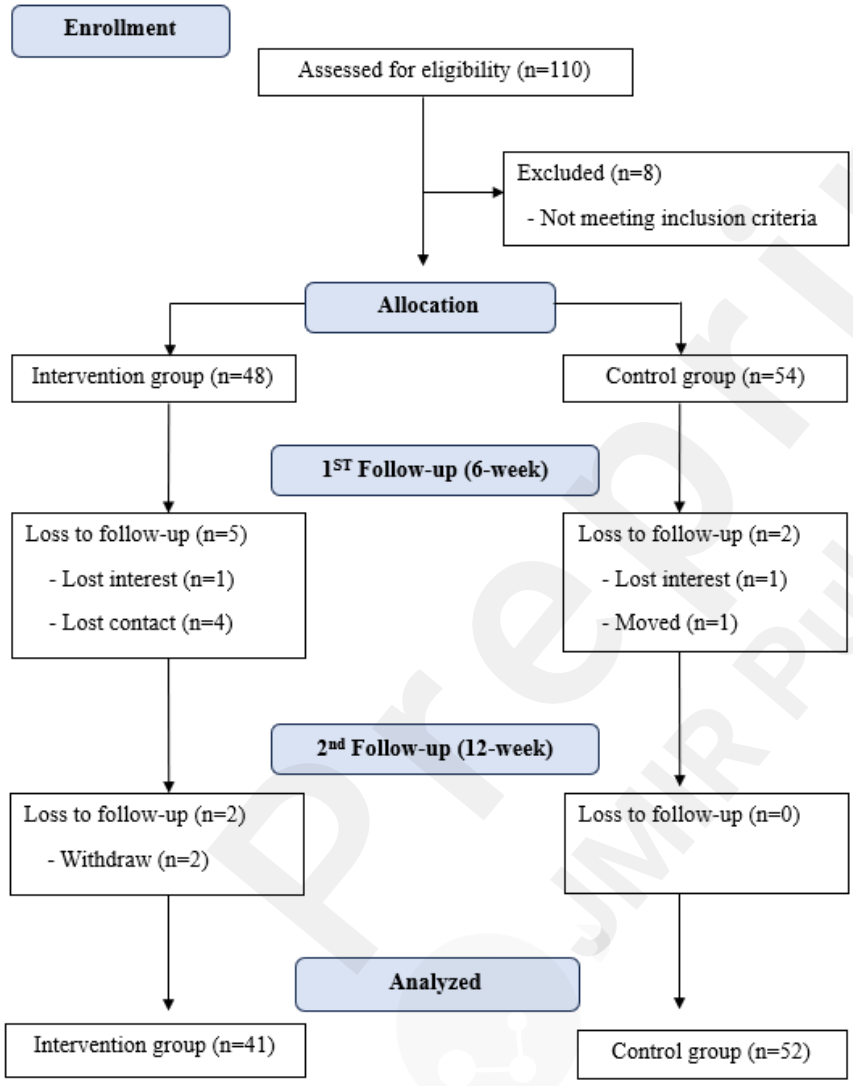


Table 1. Homogeneity of general characteristics in two groups with Parkinson's disease

(N = 93)

Variables	†Experimental group (n = 41)	Control group (n = 52)	x^2 or t	p
	n (%) or M±SD	n (%) or M±SD		
Sex				
Male	14 (34.1)	24 (46.2)	1.368	.291*
Female	27 (65.9)	28 (53.8)		
Age (years)	62.20±8.23	62.19±6.25	-.002	.999
Income (months)				

Variables	†Experimental group (n = 41)	Control group (n = 52)	x^2 or t	p
< $2,000	25 (61.0)	31 (59.6)	.091	1.000*
$2,000 - $2,990	5 (12.2)	7 (13.5)		
> $3,000	11 (26.8)	14 (26.9)		
Marital status				
Single	2 (4.9)	0	4.281	.348*
Married	32 (78.0)	45 (86.5)		
Cohabitation	0	0		
Widow/widower	2 (4.9)	3 (5.8)		
Separation	0	1 (1.9)		
Divorced	5 (12.2)	3 (5.8)		
Education				
No education	0	1 (1.9)	2.780	.823*
Elementary school	1 (2.4)	1 (1.9)		
Middle school	6 (14.6)	6 (11.5)		
High school	17 (41.5)	28 (53.8)		
University/college	13 (31.7)	12 (23.1)		
Graduate school	4 (9.8)	4 (7.7)		
Caregiver				
No	3 (7.3)	1 (1.9)	1.620	.317*
Yes	38 (92.7)	51 (98.1)		
Living arrangements				
Reside apart from the caregiver	0	3 (5.8)	3.434	.196*
Reside with the caregiver	38 (92.7)	48 (92.3)		
No caregiver	3 (7.3)	1 (1.9)		
Employment				
Unemployed	18 (43.9)	24 (46.2)	2.929	.236*
Employed	15 (36.6)	24 (46.2)		
Retired	8 (19.5)	4 (7.7)		
Disease severity (UPDRS Ⅲ)				
Provided records	40 (22.37±10.61)	49 (20.55±10.49)	.804	.423
No records	1	3		
Disease duration (months)	85.21±56.61	75.78±63.68	.755	.452
Number of comorbidities				
None	16 (39)	22 (42.3)	3.837	.759*
1	16 (39)	15 (28.8)		
2	6 (14.6)	5 (9.6)		
3	1 (2.4)	4 (7.7)		
4	1 (2.4)	3 (5.8)		
5	1 (2.4)	2 (3.8)		
6	0	0		
Self-care (SC-CII)				
Maintenance	58.78±12.27	60.67±11.09	.779	.438
Monitoring	60.57±14.00	60.77±13.36	.070	.944
Management	59.92±12.19	60.06±11.42	.059	.953

†Testing a mobile app to monitor self-care; *Fisher exact test; M, mean; SD, standard deviation; UPDRS Ⅲ, Unified Parkinson's Disease Rating Scale part Ⅲ; SC-CII, Self-Care of Chronic Illness Inventory.

3.2. Effect of the Yon PD® app on self-care

The results of the repeated-measures ANOVA are presented in Table 2. Scores for self-care maintenance satisfied the Mauchly test of sphericity, a test that confirms the assumptions of repeated-measures ANOVA (*W*=.989; x^2(2)=1.002; *p*=.606). Regarding self-care maintenance, there was a statistically significant interaction effect between groups and time (*F* (2,182)=4.087; *p*=.018). Thus, using the Yon PD® app was effective in increasing self-care maintenance (Figure 2). Scores for self-care monitoring also satisfied the Mauchly test (*W*=.953; x^2(2)=4.354; *p*=.113), and there was a statistically significant interaction effect between groups and time on self-care monitoring (*F* (2,182)=3.155; *p*=.045). Scores for self-care monitoring decreased slightly at 12 weeks compared to the baseline, but using the Yon PD® app was effective in maintaining the level of self-care monitoring (Figure 3). Scores for self-care management also satisfied the Mauchly test of sphericity (*W*=.980; x^2(2)=1.817; *p*=.403). In the two groups, self-care management scores changed depending on the measurement period. However, there was no statistically significant interaction effect between groups and time (*F* (2,182)=1.348; *p*=.262). Therefore, using the Yon PD® app was ineffective in increasing self-care management (Figure 4).

Table 2. Effect of the Yon PD app on self-care in people with Parkinson's disease*

(N = 93)

Variables	Groups	Baseline	6-week	12-week	Sources	*F* or *t*	*p*
		M±SD	M±SD	M±SD			
Maintenance	Experimental	58.78±12.27	61.71±10.86	60.18±10.34	Group	.776	.381
	Control	60.67±11.09	57.55±10.22	57.31±12.08	Time	.469	.626
					GxT	4.087	**.018**
Monitoring	Experimental	60.57±14.00	64.15±15.29	59.35±13.85	Group	1.277	.261
	Control	60.77±13.36	57.50±14.46	56.92±16.58	Time	2.408	.093
					GxT	3.155	**.045**
Management	Experimental	59.92±12.19	61.71±13.95	44.96±11.79	Group	.795	.375
	Control	60.06±11.42	57.56±12.35	43.33±12.78	Time	95.051	**< .001**
					GxT	1.348	.262

*Analyzed using the repeated-measures analysis of variance (ANOVA)
Experimental group-with app (n=41); control group-without app (n=52); M, mean; SD, standard deviation; GxT, group x time

Figure 2. Effect of using a mobile app for self-care maintenance in two groups with Parkinson's disease

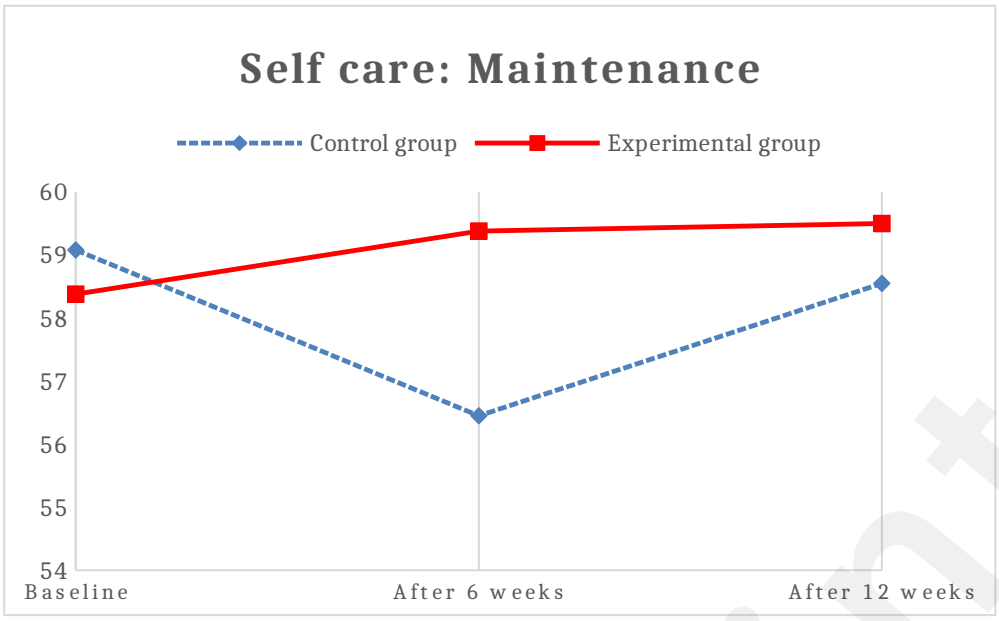


Figure 3. Effect of using a mobile app for self-care monitoring in two groups with Parkinson's disease

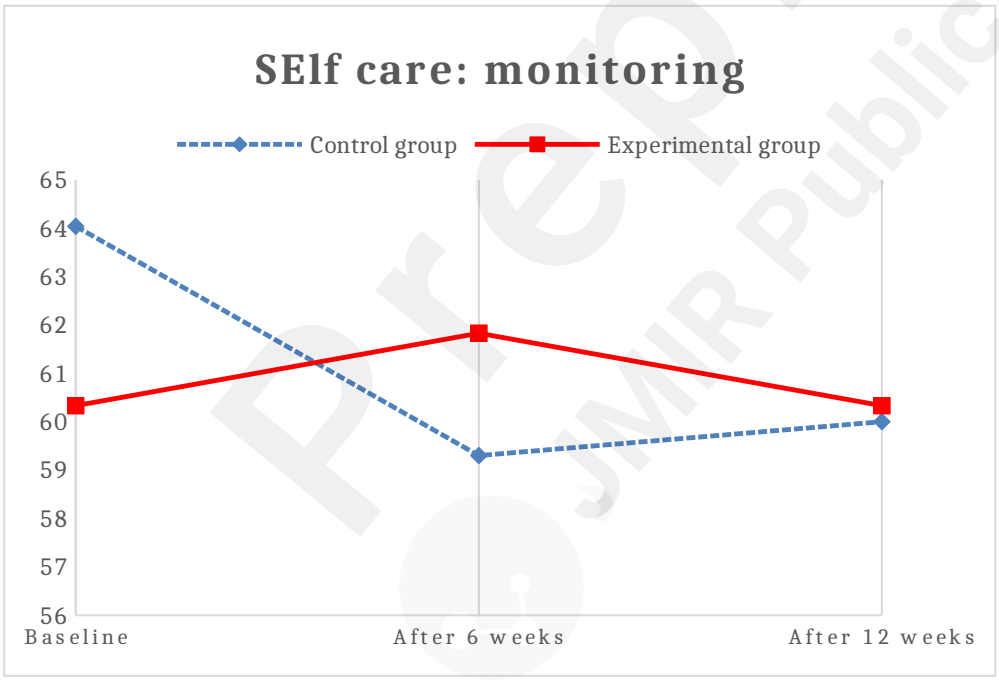
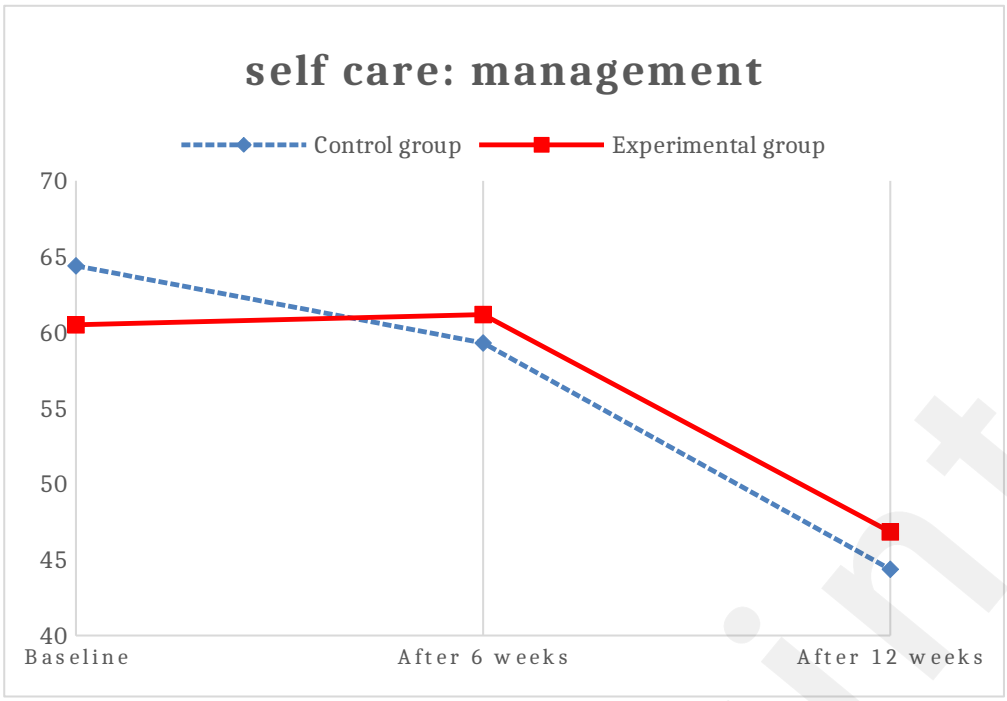


Figure 4. Effect of using a mobile app for self-care management in two groups with Parkinson's disease



3.3. Adherence rate and satisfaction with the Yon PD® app

The adherence rate was calculated as the total number of records divided by the number of required records. The overall 12-week adherence rate was 51.36% in the intervention group and 56.2% in the control group. In the intervention group, the adherence rate was 60.84% at 6 weeks from baseline; the adherence rate gradually decreased after 6 weeks and was reported to be 41.87% at 12 weeks. A similar pattern was found in the control group; the adherence rate was 63.24% at 6 weeks and 51.37% at 12 weeks.

Among the 41 PwP in the intervention group, 22 reported satisfaction with the Yon PD® app. The average satisfaction score was 81.14±24.46. The possible total scores ranged from 18 to 126; therefore, the average score was in the moderate to high range. Relatively low average scores were reported for items 9 and 16: “Did you feel comfortable using the application anywhere?” and “Does the application have all the features and requirements you expected?” In contrast, relatively high average scores were given to items 3 and 5: “Was it convenient to operate the screen?” and “If you made a mistake while using the application, were you able to correct it easily and quickly?” Detailed information on each

item and the average scores are presented in Appendix A.

4. Discussion

This study investigated whether monitoring the non-motor symptoms of PD with the Yon PD® app affected self-care over a 12-week period. As mentioned in the introduction, we had previously developed the Yon PD® app and completed a 6-week feasibility study.[17,18] A notable difference in the current study was that the effectiveness of the Yon PD® app was tested on a larger number of PwP over a longer period. This study also contributed to the provision of advanced mobile healthcare services to PwP by assessing adherence rates and satisfaction with the Yon PD® app.

The PwP involved in this study had a moderate level of self-care maintenance, monitoring, and management at baseline. Our findings demonstrated that monitoring the non-motor symptoms of PD using the Yon PD® app could be helpful in promoting self-care maintenance and monitoring. Notably, self-care management gradually decreased in the intervention group even though the Yon PD® app was provided; however, this trend was also found in the control group. Based on the information-motivation-behavioral skills (IMB) model, we speculate that these findings may be due to the individuals' lack of motivation to change their health behaviors.[29] The IMB model explains how information, motivation, and behavioral skills affect the individual's behaviors. In a recent qualitative study, the degree of self-care management was shown to be influenced by various factors including health beliefs, time spent with healthcare professionals, and access to health information.[30] In the present study, researchers made follow-up calls to PwP who were inconsistently using the Yon PD® app to ask about difficulties they might be having and provide necessary information. However, it appears that these follow-up calls were insufficient to stimulate motivation for self-care management.

In previous studies, motivational interviewing has been widely used to promote self-care in chronic disease populations. Motivational interviews are feasible using various methods, but face-to-face meetings were shown to be more effective than other methods in some studies.[31] In a randomized controlled study that examined the effect of the motivational interview, heart failure patients were given the opportunity to build supportive relationships with healthcare professionals and discuss their challenges.[32] For patients who had difficulty changing behaviors, the authors praised them whenever they made small behavioral changes. When the motivational interview was implemented over one year, these strategies effectively improved patients' self-care in all domains.[32] To maximize self-care effect of the Yon PD® app, motivation to use the app should be stimulated. Continuous follow-up calls, motivational interviews, and adding fun games to the app could be considerable options to increase motivation.

could also use various strategies to stimulate motivation for caring non-motor symptoms.

In the intervention group, self-care monitoring scores increased for 6 weeks but decreased thereafter. It is speculated that the changes in self-care monitoring might be related to the rate of compliance with the Yon PD® app. Like the self-care monitoring scores, adherence rates increased over 6 weeks and then decreased thereafter. Because the intervention group monitored non-motor symptoms using the Yon PD® app, poor adherence to the Yon PD® app may lead to decreased interest in self-care monitoring. According to a study that reviewed adherence to technology-based interventions in older adults, a lack of motivation and enjoyment could be one of the reasons for a decreased adherence rate.[33] Thus, stimulating motivation to use the intervention and providing the intervention in an enjoyable format are important for increasing adherence rates. Providing tailored advice and ambient information regarding the patient's particular non-motor symptoms, as well as encouraging a positive experience with the application that helps

them engage more actively, could be good strategies.[34] Overall, satisfaction with the Yon PD® app was moderate to high. There were some minor technical issues with the internet network, but these issues could be improved with a software update.

5. Limitations

This study provided evidence of the efficacy of application-based healthcare in PwP. Since the COVID-19 pandemic swept the world, the need for technology-based healthcare has increased dramatically. A mobile application was chosen as the delivery method for technology-based healthcare in this study because smartphones are widely used worldwide. A mobile application can be a convenient and practical way to manage health, even for older adults. This study also provided evidence for the importance of monitoring non-motor symptoms. Our findings suggest that self-care in PwP can be improved by regular monitoring of non-motor symptoms. A limitation of this study was that we only examined the perceived level of self-care. If actual behavioral changes had been objectively evaluated, the effectiveness of the Yon PD® app could have been more extensively evaluated.

6. Comparison with Prior Work

Our findings suggest that the Yon PD® app is feasible and effective in improving self-care in PwP. Unlike other chronic diseases such as cancer and diabetes, mobile-based interventions for PD have been lacking. By using the Yon PD® app, PwP can monitor their non-motor symptoms more systematically and quickly identify changes in symptoms. In addition, it is expected that improved self-care will reduce medical costs and increase quality of life. The transmitted records from the Yon PD® app can also be a good source of information for healthcare professionals assessing the non-motor symptoms of PwP. This also allows healthcare professionals to manage PwP remotely, even during infectious

disease outbreaks or pandemics.

7. Conclusions

A high level of self-care is important for health maintenance in chronic disease populations. To promote self-care in PwP, we examined the effectiveness of the Yon PD® app, a mobile application that can monitor and record the non-motor symptoms of PD. The Yon PD® app was effective in increasing self-care maintenance and preventing a decline in self-care monitoring. However, it was not effective in improving self-care management. Additional strategies to improve motivation and enjoyment should be established to increase the effectiveness and adherence rate of the Yon PD® app.

8. Conflicts of Interest

None.

9. Data availability

Data supporting the findings of this study are available on request from the corresponding author.

10. Abbreviations

PD: Parkinson’s disease

PwP: People with Parkinson’s disease

SC-CII: The self-care of chronic illness inventory

ANOVA: The repeated-measures analysis of variance

IMB: The information-motivation-behavioral skills

UPDRS Ⅲ: The unified Parkinson’s disease rating scale part Ⅲ

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Supplementary Files

Multimedia Appendixes

This table refers to the satisfaction with the Yon PD app.
URL: http://asset.jmir.pub/assets/26d0edb1d8acb92fb7f78f68ed7c2812.docx

CONSORT (or other) checklists

This refers to a checklist.
URL: http://asset.jmir.pub/assets/376087988228f3807c566068aae04035.pdf