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Original Article

Improvements of sleep quality and QOL by Roy Adaptation Model in nursing of patients with Parkinson's disease

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Abstract: Objective: This study was designed to explore the improvements of sleep quality and QOL by implementing the Roy Adaptation Model for nursing of patients with Parkinson's disease (PD). Methods: In total, 90 PD patients were included as the study subjects and were divided into 2 groups by a Random Number Table. The control group (n=45) was given routine nursing care, while the observation group (n=45) was subject to nursing intervention measures based on the Roy Adaptation Model. All patients were assessed for QOL, sleep quality and improvements in motor functions of their extremities via Parkinson's Disease Quality of Life Questionnaire (PDQL), Pittsburgh Sleep Quality Index and Fugl-Meyer Motor Assessment Scale - Balance Subscale (FM-B), during and 1 month after they were hospitalized; additionally, changes in iron content of the lenticular nucleus were compared before and after intervention. Results: Before nursing, no statistical difference was observed between the 2 groups in terms of PDQL, PSQI, FM-B, magnetic sensitivity of the lenticular nucleus and substantia nigra (P>0.05). One month after nursing, the observation group exceeded the control group after a marked decrease in PDQL and PSQI, and an elevation in FM-N (P<0.05); both groups reported marked decrease in brain magnetic sensitivity, which was more prominent in the observation group (*P*<0.05). The incidence of complications in the observation group was slightly lower than that of in the control group (*P*>0.05). Conclusion: During treatment, the adoption of the Roy Adaptation Model to nurse PD patients has the advantages of alleviating sleep disorders, promoting absorption and removal of iron in brain, and improving function of extremities, QOL and treatment safety.

Keywords: Parkinson's disease, Roy Adaptation Model, sleep quality, QOL, quantitative susceptibility mapping

Introduction

Parkinson's disease (PD) is a dyskinesia disease mostly found in middle-aged and senior populations, with principal pathologic manifestations of damage and denaturation of the substantia nigra-lenticular nucleus pathway, abnormal deposition of iron content in these lesions, from which the clinical manifestations show muscle rigidity and postural instability, etc. This disease has severely compromised the QOL of patients. Some data have indicated that scientific nursing at the early stage of onset can boost motor function [1, 2]. The Roy model is an integrated adaption system emphasizing the interactions between humans and their environment [3]. By using stimulation, medical workers can promote patients' adaptation reaction and reduce resistance to stronger stimulation as their adaptation scope expands, and apply more energy to help patients recover [4]. This study analyzed the clinical value of the Roy Adaptation Model in treatment of PD patients.

Materials and methods

Materials

Ninty PD patients admitted to our hospital from March 2017 to March 2019 were included as the study subjects and equally divided into 2 groups by a Random Number Table. (1) Inclusion criteria: patients with PD diagnosis criteria formulated on the 4th National Symposium on Extrapyramidal Diseases of Chinese Medical

Association, being aged 50 or above, PSQI greater than 7 [5] and who have provided Informed Consent were included in this study. The study was approved by the ethics committee of the hospital. (2) Exclusion criteria: some patients were excluded as they had severe cognitive dysfunction resulting in an inability to cooperate with the nursing, concurrent diseases of the metabolic system, hematopoietic system, endocrine, malignant tumor, or previous history of epilepsy, etc.

Methods

The control group was routinely nursed from the following aspects: ① health education and mental intervention: patients attended lectures on knowledge about PD with their family members and were comprehensively evaluated for metal status. In case of negative emotions such as loneliness and a feeling of loss, more intensive psychological counseling services and close exchanges were provided to understand the causes leading to their unhealthy emotions, and to help them establish confidence with encouraging and comforting language; in the meanwhile, family members were required to stay with patients more to eliminate any unhealthy emotions. ② Medication nursing: patients were required to comply with the doctor's advice on the time and dose of taking medicines, introduced the names of drugs and their mechanisms, and the importance of sustained medication; family members were guided to supervise patients in taking medicine to elevate their compliance in treatment. ③ Guidance on exercise: at early stages, patients were required exercise by bending and stretching their extremities maximally to avoid ankyloses and crispation; nurses massaged their extremities when patients were resting to accelerate local blood circulation [6]. ④ Diet: daily diet provided sufficient nutrients and were consumed slowly. Plenty of hydration was also required.

Based on the Roy Adaptation theories, the observation group was treated in terms of physiology, role, dependence and self-concept.

Physiological intervention: attention was given to encourage improvement in physiological functions of patients; stimulation includes therapeutic operations and timely attention in the night. The following intervention measures were adopted: improvement in ward environment by regulating indoor temperature and humidity; advise patients to avoid any food containing caffeine 4-6 h before sleep, take a hot water foot bath if conditions permit; reduce night treatments or concentrate them in a certain time period to avoid disturbing patients' rest during the night. Therapeutic operations during night rounds shall follow the 4 principles of "gentle operations, speaking, walking and door shutting". Patients with sleep disorders cooperate with the doctors to take symptomatic measures.

Role intervention: role function relates to patients adapting to their new arrangements in a short period of time; such as changes in lifestyle and sleep environment; frequent contact with unfamiliar medical workers and other patients in addition to their family members and friends. Nursing measures: patients' habits were maintained as far as possible; patients' requirements were responded to if appropriate, for instance, a quiet environment for unsociable and eccentric patients, encouragement the to be outgoing and communicate with other patients, and enhancing communication between medical workers and patients to help them build confidence in defeating their disease.

Dependence intervention: reduction in social activities after hospitalization, providing a relaxing environment and neutral colors in hospital, and companionship from family members, with restricted visit and movement during their stay in hospital, etc. Nursing measures: enhanced communication and psychological support are provided to patients, especially in the night when family members stay with patients to eliminate their loneliness.

Intervention of self-concept: patients worry about the treatment effects, this includes medical expenses, and the impact on family life and work. Nursing measures: after hospitalization, an amicable relationship is established between patients and medical workers, proper education was selected and an individualized health education plan was established according to patients' educational background to help them understand their disease and its treatment in detail. Moreover, patients' family members cooperated for ideological work to relieve patients from worries about finance, upset and

guilt from bringing troubles to their family members.

Observation indices

QOL assessment: the 2 groups were assessed for QOL by a 37-questionaire PDQL, during and 1 month after hospitalization, looking at 4 dimensions of PD symptoms, systemic symptoms, emotional function and social function. Answers to each question are selected from 5 options: always (1 point), mostly (2 points), sometimes (3 points), occasionally (4 points) and never (5 points).

Improvements in sleep disorders: the 2 groups were assessed by PSQI [7] which consisted of 19 self-assessment items and 5 peer assessment items. Seven dimensions were covered in the assessment, including subjective sleep quality, bed time, sleep time, sleep efficiency, sleep disturbances, hypnotic drug and daytime function (each valuing 0 to 3 scores). The total score varied from 0 to 21 and is negatively associated with sleep quality.

Assessment of balance functions of extremities: FM-B [8] was relied on to assess 7 aspects of patients movements, including sitting without support, standing without support, standing with support, stretching on the sick/healthy side, and standing on a single foot on the sick/healthy side. To each movement a score is given from 3 choices; 0 (failure), 1 (partial success) and 2 (success). The total score varies from 0 to 14, and is positively associated with the balance function of the extremities.

QSM: MRI examination (GE Silent 3.0T MRI System from the USA, ADW4.5 Workstation) was performed before and 1 month after intervention according to the sequence of routine scanning which included profile scanning of T1WI, T2WI, fluid attenuated inversion recovery (FLAIR), and sagittal scanning of T1WI to exclude any other organic lesions, and then sequence scanning with TR of 28 ms, TE of 20 ms, flip angle of 15°, visual field of 23 cm × 17.3 cm, matrix of 22.1 cm × 32 cm, distance between layers of 1.2 mm, bandwidth of 31.75 Hz and incentive time of 1. The brain images and data were uploaded to the workstation and processed for information to inspect the magnetic sensitivity in areas where iron deposits in the substantia nigra and lenticular nucleus on both sides [9]. Two to 3 senior physicians (with service length ≥10 y) with an abundance of experience in MRI diagnosis of the nervous system were engaged to map the regions of interest (ROI), measure the iron content, compare changes in iron content of the substantia nigra and lenticular nucleus before and after intervention, and come to an agreement after discussion in the case of different opinions.

Complication: the 2 groups' incidence of adverse reactions was recorded during treatment.

Statistical analysis

Statistical analysis was performed with SPSS 22.0. In case of nominal data expressed as (%), comparison studies were carried out through X^2 test. In case of numerical data expressed as $\bar{x} \pm s$, comparison studies were carried out through independent-samples T test for data which were normally distributed, and Mann-Whitney U test for data which were not normally distributed, paired test for pre-and-pro comparison in the group. For all statistical comparisons, significance was defined as $P<0.05$.

Results

Comparison between the 2 groups in basic measures

The control group (n=45) included 29 males and 16 females, whose ages varied from 54 to 76 years with mean value of (61.28±4.20), and course of disease ranged from 2 to 8 years with mean value of (4.02±0.58), among whom, 16 were mildly sick, 21 moderately sick and 8 severely sick. The observation group (n=45) included 25 males and 20 females, whose ages varied from 52 to 78 years with mean value of (62.05±3.60), and course of disease ranged from 2 to 8 years with mean value of (4.21±0.82), among whom, 13 were mildly sick, 23 moderately sick and 9 severely sick.

Comparison between the 2 groups in QOL scores before and after nursing

Before nursing, the 2 groups demonstrated no statistical difference in PDQL score ($P>0.05$). One month after nursing, the observation group

Table 1. Comparison between the 2 Groups in PDQL Scores before and after Nursing ($\bar{x}$ ± s, score)

Item	Time	Control group (n=45)	Observation group (n=45)	*t*	*P*
PD symptoms	Before nursing	47.63±7.52	48.03±5.81	0.282	0.778
	1 month after nursing	7.54±2.05*	2.17±0.56*	16.951	<0.001
Systematic symptoms	Before nursing	24.06±5.11	23.74±6.30	0.265	0.792
	1 month after nursing	4.38±1.62*	3.26±0.57*	4.375	<0.001
Emotional function	Before nursing	32.41±5.23	31.85±6.33	0.458	0.648
	1 month after nursing	5.41±1.83*	4.15±1.26*	3.804	<0.001
Social function	Before nursing	22.93±6.20	24.42±5.82	1.175	0.243
	1 month after nursing	7.55±2.81*	5.34±1.49*	4.661	<0.001
Total score	Before nursing	127.14±6.37	125.85±7.22	0.899	0.371
	1 month after nursing	24.86±2.81*	14.95±3.12*	15.832	<0.001

Note: *P<0.05 as compared with conditions before nursing.

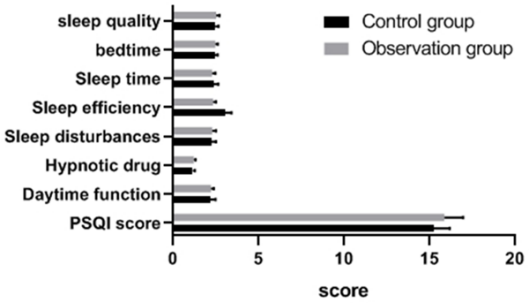

Figure 1. Comparison between the 2 groups in PSQI score before nursing. Before nursing, the 2 groups had no statistical difference in subjective sleep quality, bed time, sleep time, sleep efficiency, sleep disturbances, hypnotic drugs and daytime function, and total PQSI score (*P*>0.05).

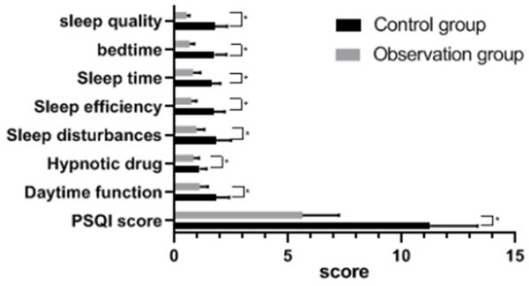

Figure 2. Comparison between the 2 groups in PSQI score 1 month after nursing. The observation group was significantly lower than the control group in subjective sleep quality, bed time, sleep time, sleep efficiency, sleep disturbances, hypnotic drug, daytime function, and total PQSI score. The difference between groups was statistically significant (*P*<0.001). **P*<0.05 indicates that the difference between groups was statistically significant.

reported scores in PD symptoms of (2.17± 0.56), systematic symptoms of (3.26±0.57), Emotional function of (4.15±1.26), Social function of (5.34±1.49) and total PDQL score of (14.95±3.12), which were (7.54±2.05), (4.38± 1.62), (5.41±1.83), (7.55±2.81), and (24.86± 2.81) in the control group, correspondingly; with *t*=16.951, 4.375, 3.804, 4.661, and 15.832, respectively (*P*<0.001, **Table 1**).

Comparison between the 2 groups in improvement of sleep quality before and after nursing

Before nursing, the 2 groups demonstrated no statistical difference in PSQI score (P>0.05). One month after nursing, the observation group reported scores in subjective sleep quality (0.52±0.34), sleep time (0.48±0.11), bedtime (0.34±0.05), sleep efficiency (0.15±0.02), sleep disturbance (0.73±0.21), hypnotic drugs (0.06±0.01), daytime function (0.68±0.12) and a total score of (2.96±0.74), which were (1.15±0.32), (0.91±0.29), (0.87±0.26), (1.03± 0.22), (1.28±0.27), (0.43±0.05), (1.38±0.29), and (7.92±1.37) in the control group, correspondingly; with *t*=9.051, 9.300, 13.428, 26.723, 10.786, 48.677, 14.962 and 21.369, respectively (*P*<0.001, **Figures 1** and **2**).

Comparison between the 2 groups in scores of extremity function before and after nursing

Before nursing, the 2 groups demonstrated no statistical difference in FM-B score (P>0.05). One week, 2 weeks and 1 month after nursing, the observation group reported FM-B scores of (8.74±1.35), (9.81±1.33), and (12.07±1.66), respectively; which were (8.24±1.40), (8.85±

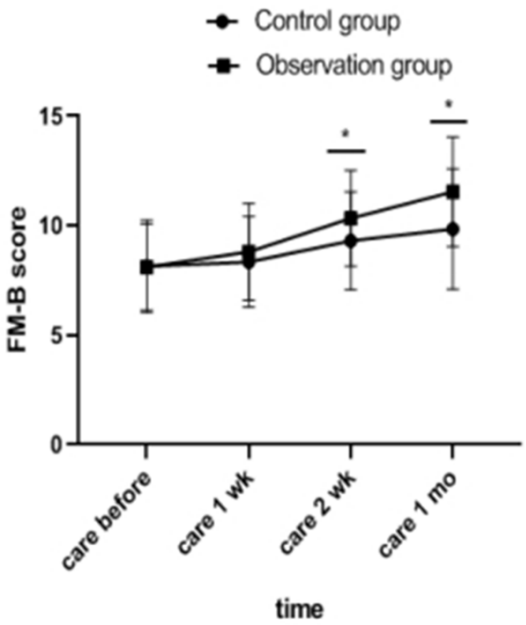

Figure 3. Comparison between the 2 groups in FM-B score before nursing. Before nursing, the 2 groups demonstrated no statistical difference in FM-B score (P>0.05). After nursing, both groups attained marketed elevation in FM-B score, which was more significant in the observation group at 2 weeks and 1 month (P<0.05). *P<0.05 indicates that the difference between groups was statistically significant.

1.52), and (9.65±1.72) in the control group, correspondingly; with t=1.725, 3.188 and 6.791, respectively (P<0.001, **Figure 3**).

Changes in magnetic sensitivities of the lenticular nucleus and substantia nigra in the 2 groups

Before nursing, the magnetic sensitivities of the lenticular nucleus and substantia nigra were 85.25±17.36 (10~3 ppm) and 125.42± 21.05 (10~3 ppm), respectively (**Figure 4**) in the observation group; 84.97±15.94 (10~3 ppm) and 127.20±22.41 (10~3 ppm); respectively in the control group. Which reduced to 62.74±10.13 (10~3 ppm) and 110.33±19.26 (10~3 ppm) respectively in the observation group (**Figure 5**), 73.61±13.28 (10~3 ppm) and 120.42±20.45 (10~3 ppm), respectively in the control group after nursing accordingly (P<0.001).

Comparison between the 2 groups in complications

The incidence of complications was 17.78% in the observation group attributing to chewing/swallowing difficulties (3), nausea/loss of appetite (4), and constipation (1), and 33.33% in the control group due to chewing/swallowing difficulties (5), nausea/loss of appetite (3), constipation (4), and orthostatic hypotension (3) (x^2=2.862, P=0.091, **Figure 6**).

Discussion

PD is a neurological disorder in which the nigrostriatal pathway degenerates [10, 11], with typical clinical manifestations of muscular rigidity, static tremor, bradykinesia and impaired postural reflex. PD is believed to be the 3rd greatest killer of middle-aged and senior populations after malignant tumors and cardiovascular and cerebrovascular diseases [12]. At present, there is no radial therapy for primary PD, and the levodopa replacement therapy, as a basic treatment scheme to alleviate symptoms in a short period of time, fails to block accumulated degeneration of dopaminergic (DA) neurons in substantia nigra pars compacta, and its long-term administration will result in various toxic reactions and even programmed deaths [13, 14]. Therefore, scientific nursing has played a vital role in easing the conditions of PD patients in treatment.

The Roy Adaptation Model, developed by Sister Callista Roy, a US scholar, in order to improve patients' treatment adaptability, has the advantages of stressing patients' adaptive behaviors in a holistic view and adopting corresponding measures to adjust their physiology, self-concept and social relations, so as to improve nursing effects as far as possible [15, 16]. In recent years, researchers have begun investigating the application values of Royal Adaption Model in treating patients with neurological disorders, including Babamohamadi [17] who explained that this model was capable of saving PD patients from negative emotions and poor QOL, and Nasrollah [18] who demonstrated the model's effect of improving the physiological adaptability of patients with cerebral apoplexy. Results obtained from the present study revealed that, 1 month after intervention, the observation group exceeded the control group in terms of PSQI and FM-B scores, indicating that the Roy Adaptation Model can relieve PD patients from sleep disorder, accelerate the recovery of limb functions and improve their physiological adaptability and QOL, which were consistent with the findings of

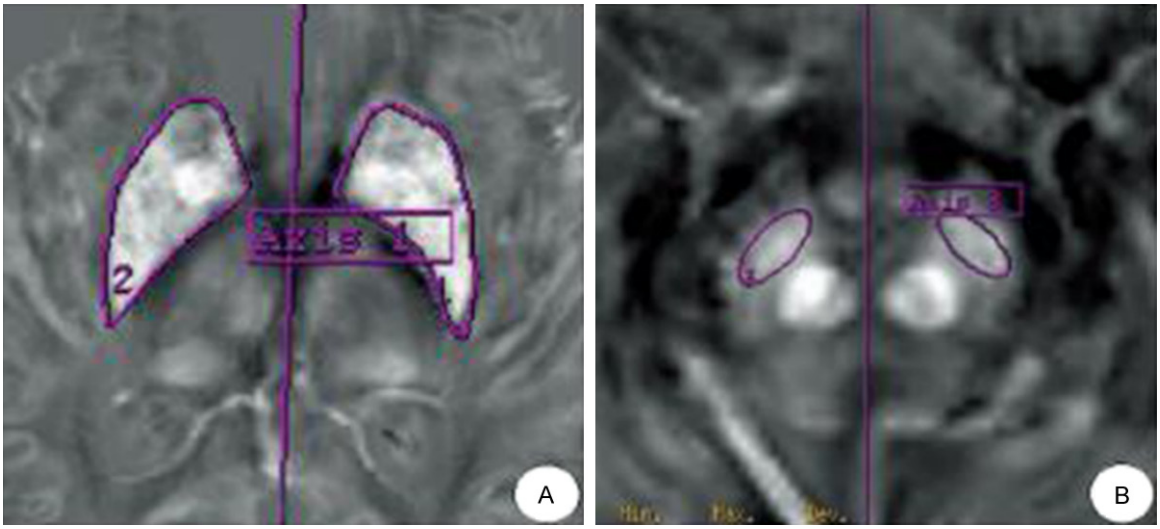

Figure 4. Magnetic sensitivity of the lenticular nucleus and substantia nigra in the observation group before nursing. Before nursing, the values reported by the observation group were 85.25±17.36 (10~3 ppm) and 125.42±21.05 (10~3 ppm).

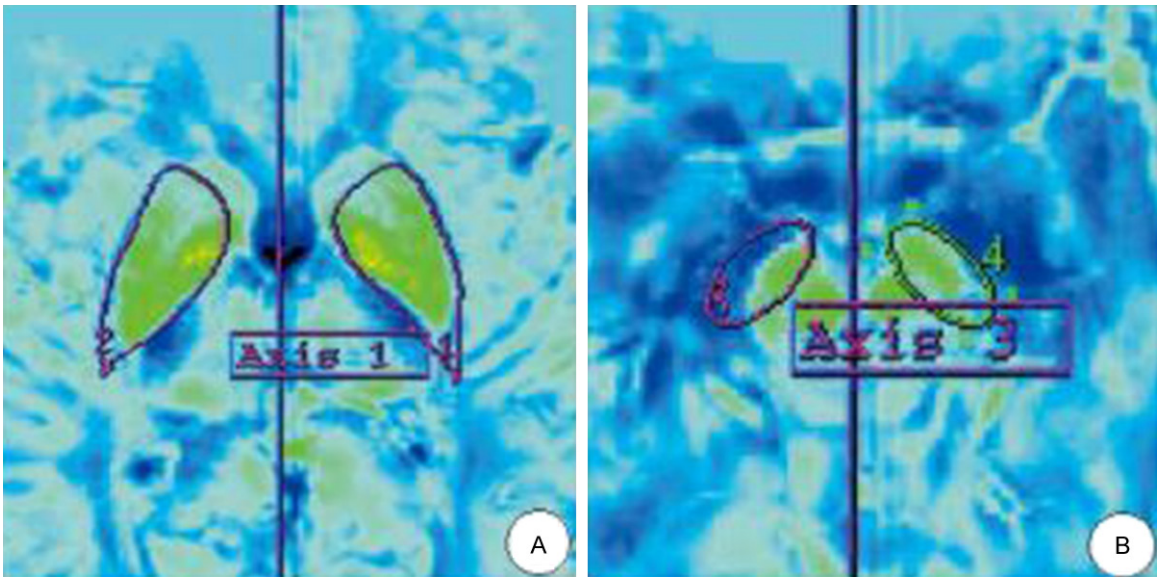

Figure 5. Magnetic sensitivity of lenticular nucleus and substantia nigra in the observation group after nursing. After nursing, the magnetic sensitivities of lenticular nucleus and substantia nigra in the observation group reduced to 62.74±10.13 (10~3 ppm) and 110.33±19.26 (10~3 ppm).

other research. The reasons for improved sleep quality, motor functions and QOL lie in the Roy Adaptation Model's role in establishing good sleep habits and heightening exercise tolerance. It guides and assists patients to make adjustment and establish the work-rest schedule, take progressive and relaxing exercise, and promote the conversion of self-regulation of nervous activities in the direction of benefiting sleep; furthermore, appropriate adjustment in exercise schemes not only improves exercise tolerance but also pleases patients mentally and reduces their sleep disorders from limited social activities [19].

Abnormal iron metabolism in the brain is closely associated with the onset of PD. Based on animal experiments and autopsy, PD patients have iron deposition changes in the basal ganglia nuclei such as corpus striatum and sub-

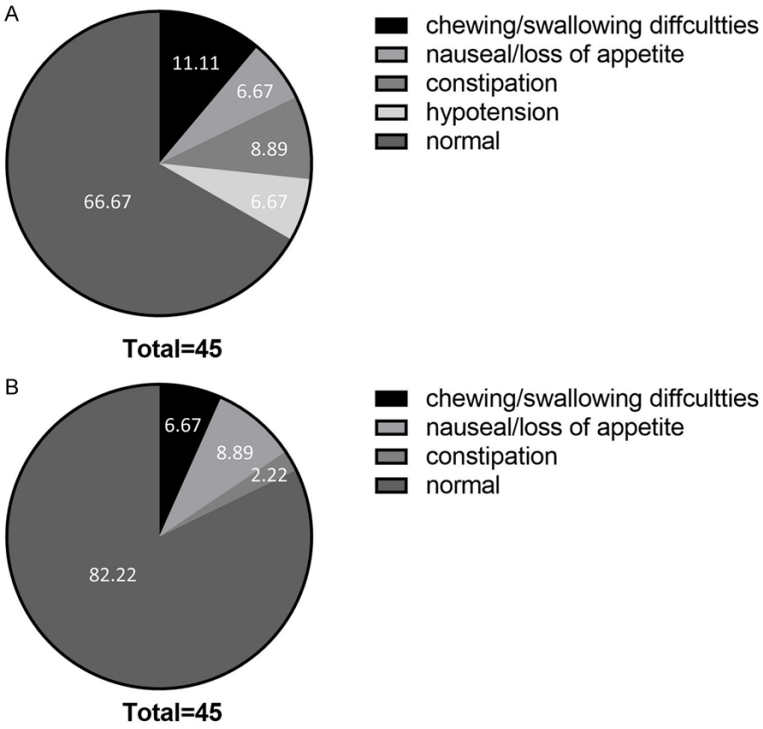

Figure 6. Incidence of complications in the 2 groups during nursing. The incidence of complications was 17.78% in the observation group and 33.33% in the control group, x^2=2.862, and no statistically significant differences were found in two groups (P=0.091).

stantia nigra [20, 21]. Most of such cases are attributed to the fact that iron and other molecules in cells have jointly participated in catalytic oxidation-reduction reactions, and Fenton reaction results in increased number of free radicals, leading to overoxidation which contributes to abnormal deposition of iron and impairment of DA neurons [22-24]. The present study adopted QSM to measure changes in iron content in the basal ganglia nuclei 1 month after intervention, and found it was reduced in the substantia nigra and lenticular nucleus. One possible reason is that drugs have promoted the absorption of iron in the brain and resulted in lower deposition. The observation group reported more significant reduction as compared with the control group, possibly due to improved motor functions, enhanced oxidation resistance and promoted iron absorption. In addition, the present study compared the complications of both groups and found that the observation group had a total incidence of complications slightly lower than the control group, and had an absence of severe complications such as urinary system infection and pneumonia, indicating that the Roy Adaptation Model can reduce patients' safety risk in treatment.

In conclusion, in addition to a reduction in incidence of complications, the Roy Adaptation Model can improve the sleep quality, recovery of limb function, absorption of iron deposition in brain, and QOL of PD patients. However, given the small sample size and short-term observation in the present study, future studies shall focus more on long-term observations based on a larger sample size, to enhance the QOL of PD patients.

Disclosure of conflict of interest

None.

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