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Effectiveness of Occupational Therapy Based Sleep Intervention on Sleep Quality and Its Impact on Quality of Life in Patients with Parkinson's Disease

Rajul K. Daftary[1], Dejul R. Dedhiya[2]

[1]Assistant Professor, [2]MOTh -Neurosciences Postgraduate student,
Department of Occupational Therapy, OT School & Centre Seth G. S. Medical College, Mumbai, India.

Corresponding Author: Dejul Dedhiya

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ABSTRACT

Parkinson's disease is a degenerative disease which has motor as well as non-motor symptoms. Most of the times non-motor symptoms are neglected in traditional management by the healthcare professionals. But these symptoms add up to the suffering of the person. Sleep disturbances are one of the commonest non-motor symptoms seen in Parkinson's disease. These symptoms affect daily life of an individual. Thus, Occupational therapy management is essential in improving sleep quality along with management of other symptoms. The aim of this study is to evaluate the effectiveness of occupational therapy based sleep intervention in improving sleep quality in Parkinson's disease. Also, this study aimed at evaluating its impact on quality of life. The study included 37 patients. The intervention program of four weeks was provided to all which was tailored made as per patients' evaluation. The results showed statistically significant result in Pittsburgh sleep quality index and WHO Quality of Life BREF scale. This study highlighted the need for customized sleep program and demonstrated the effectiveness of occupational therapy based sleep intervention.

Keywords: sleep, sleep quality, occupational therapy, Parkinson's disease, neurorehabilitation, quality of life.

INTRODUCTION

Parkinson's disease (PD) is a complex progressive neurodegenerative disease. [1] The clinical features historically associated with PD are the triad of motor symptoms, namely, tremor, rigidity, and bradykinesia, with postural instability often appearing as the disease progresses. [1] Nonmotor symptoms (NMS) including impaired olfaction, constipation, nocturia, neuropsychiatric symptoms, and sleep disturbances are also common and can precede the clinical diagnosis of PD by many years. [2]

As the disease progresses, so does the severity of motor and non-motor symptoms. [3], and it has been postulated that the various subtypes have distinct pathogenesis and etiologies [4] .

Non-motor symptoms have a significant impact on the patient's quality of life [5]. The progression of NMS is pivotal in the worsening of the QoL throughout the evolution of the disease in PD [6]

Sleep is crucial for people's health and well-being. Sleep is one of the primary activities of the brain during early development and plays an important role in healthy cognitive and psychosocial development in early life. [7] Lack of sleep can adversely affect people's cognitive performance, [8, 9, 11] and poor sleep is a significant contributing factor to depressive mood and related emotional disorders [10, 11]. Sleep disturbances are one of the most common NMS in PD affecting about 60% to 90% of patients. [12] Patients with PD often have frequent early awakening, sleep fragmentation, insomnia,

nocturnal cramps, and nightmares, as well as impaired motor function during the night. [13] Motor fluctuations of tremor and rigidity were significantly associated with difficulty falling asleep, obtaining too little sleep and awakening too early in this study. As insomnia typically results from underlying symptoms of Immobility in bed due to hypokinesia from PD has also been associated with an increased wake after sleep onset [2, 14]. Sleep disturbances compromise nighttime sleep quality as well as daytime activities and quality of life (QoL) of patients and caregivers and may affect motor as well as cognitive function, mood, and driving ability adversely. [15,16,17,18] However, NMS are still underreported and underestimated in clinical routine, partially due to a lack of knowledge regarding their association with PD as well as scarce therapeutic options [12]. The evidence for medical treatment of insomnia in PD is scarce [19].

Rest and sleep are "activities related to obtaining restorative rest and sleep to support healthy, active engagement in other occupations" by Occupational Therapy Practice Framework (AOTA 2020 4TH edition). [20] Over the last years, the occupational therapy literature has increasingly addressed non-pharmacological sleep interventions to enhance clients' sleep quality. [21]

Activities of Daily Living (ADL), work, leisure, rest, and sleep performance; all are managed due to balance in functioning of client factors, including sensorimotor, psychosocial, and cognitive systems. All of these systems can be affected by the progressive manifestations of symptoms common to PD. Since causes are multifactorial, it adds to the complexity of the treatment. This was the rationale for conducting this study. As overall aim of treatment in PD is to lower the negative impact of the disease on health, functioning and quality of life of patients.

Many treatment interventions in various systematic reviews have been found effective. It is essential to recognise sleep disturbances and provide adequate intervention. Further development of sleep management from an occupational therapy perspective will strengthen the role of OT in sleep management.

AIM:

To evaluate the effectiveness of occupational therapy based sleep intervention on sleep quality and quality of life in patients in Parkinson's disease.

MATERIALS & METHODS

Ethical approval: The study protocol, informed consent form, and case record form were reviewed and approved by an institutional ethics committee. The study was initiated after receiving the approval from the institutional ethics committee. The study ethics approval number is EC/103/2021.

It is a prospective pre-post intervention study design. The study was conducted in tertiary care hospital in Mumbai, Maharashtra, India.

Study tools:

Pittsburgh Sleep Quality Index:

This questionnaire assesses sleep quality and disturbances over a 1-month interval using 19 questions based on seven components of subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Each question ranges in score from 0 to 3 and the score of each component can be up to a maximum of 3. The sum of these seven component scores determines the overall score, which ranges from 0 to 21. Higher scores indicate lower sleep quality and a score higher than 5 indicates poor quality of sleep. Acceptable measures of internal homogeneity, consistency (test-retest reliability), and validity were obtained. A global PSQI score > 5 yielded a diagnostic sensitivity of 89.6% and specificity of 86.5% (kappa = 0.75, p < 0.00l) in distinguishing good and poor sleepers. [30]

PSQI permission was taken from author for use. Scale in English was provided by author. Hindi and Marathi translations were obtained from Mapi Research trust. Request number:

2104669.
(https://eprovide.mapitrust.org/instruments/pittsburgh-sleep-quality-index)

WHO Quality of Life (QOL) BREF:
The WHOQOL-BREF is a self-administered questionnaire comprising 26 questions on the individual's perceptions of their health and well-being over the previous two weeks. Responses to questions are on a 1-5 Likert scale where 1 represents "disagree" or "not at all" and 5 represents "completely agree" or "extremely". The WHOQOL-BREF self-assessment was completed, together with socio-demographic and health status questions. Analyses of internal consistency, item–total correlations, discriminant validity and construct validity through confirmatory factor analysis, indicate that the WHOQOL-BREF has good to excellent psychometric properties of reliability and performs well in preliminary tests of validity. These results indicate that overall, the WHOQOL-BREF is a sound, cross-culturally valid assessment of QOL, as reflected by its four domains: physical, psychological, social and environment. [31]
WHO QOL BREF scale of all the three languages was obtained with permission from World Health Organization (WHO), (December 1996), https://www.who.int/tools/whoqol.
(Accessed: 19/4/2021). 378777is the application number.
Subjects willing to participate were recruited from Outpatient Department (OPD) of OT Department. Patients coming with confirmed diagnosis and referred to OT Department were screened for the study and with consent, they were recruited.

Inclusion criteria:
a. Patient who gives consent
b. Both the genders
c. Age between 30-60 years
d. Patient diagnosed with confirmed diagnosis of idiopathic Parkinson's disease and coming to Occupational therapy department.
e. Patients who are ranging from stages one to four on modified Hoehn and Yahr scale.
f. Complains of sleep disturbances since one month.

Exclusion criteria:
a. Patient who are unable to communicate.
b. Patient who are diagnosed with any psychiatric disorders.
c. Presence of any other chronic illnesses such as cardiological,
d. respiratory, urinogenital, gastrointestinal or multiple comorbidities.
e. Patients on any pharmacological intervention/treatment for sleep disturbances.

Sample size was calculated statistically and came to minimum 37 in order to prove effectiveness of intervention significant. Sample size was determined using the estimates of mean and standard deviation values from literature using the formula,

$$n = \frac{(Z\alpha + Z\beta)^2 [s]^2}{d^2}$$

where Zα is the z variate of alpha error i.e. a constant with value
1.96, Zβ is the z variate of beta error i.e. a constant with value 0.84
(Reference: Allen JC. Sample Size Calculation for Two Independent
Groups: A Useful Rule of Thumb. Proceedings of Singapore
Healthcare 2011:20(2);138-40)
Approximate estimates:
1. 80% power
2. Type I error to be 5%
3. Type II error to be 20%
4. True difference of atleast 1.1 units between the time intervals
5. Pooled standard deviation of 2.4

Substituting the values,

$$n = \frac{(2.8)^2 [2.4]^2}{(1.1)^2}$$

$$n = 37.32$$

Consent was taken from the patient. Screening was done of recruited participants on the basis of inclusion and exclusion criteria. Individualized occupational therapy

intervention was provided after conducting assessment. Assessment was done pre and post intervention. Individualised protocol was set for duration of 4 weeks. Follow up was once in a week. Client attended once in a week and each session lasted for 45-60 minutes. Protocol was based on Person Environment Occupation Performance model (PEOP) of occupational therapy.

The intervention used in the current study is based on PEOP model; it comprised of a combination of common interventions used for patients with sleep problems.

SR NO	INTERVENTIONS	
1	SLEEP EDUCATION	Educational approach was used by conducting discussion with the client on Architecture of sleep, concept of sleep quality, importance and need of sound sleep. A 20-30 minutes session was taken
2	SLEEP HYGIENE MEASURES	Education on caffeine intake reduction, excessive night-time eating, and smoking cessation, restrictions on use of various screen-based gadgets
3	AEROBIC EXERCISES	Moderate levels of aerobic exercises during the week lasting 10 to 30 minutes, such as walking, spot marching, transferring light weight objects in different degrees of freedom in sitting and standing positions, leg mobility exercises in lying down position were prescribed. They were advised to do it 4 hours before falling asleep
4	STRETCHING EXERCISES	Stretches such as Bear hugs, hand stretches in sitting, side stretch, knee to chest, spinal twist, butterfly stretch, cat & camel stretch were prescribed to be performed. Each stretch poses to be maintained 30 seconds. Each stretch to be performed 5 repetitions everyday two times in a day.
5	ACTIVITY SCHEDULING	Coaching approach was used. In collaboration with the client, daytime routine was planned and organised.
6	FATIGUE MANAGEMENT	Jacobson's Relaxation was taught and advised to be practised before falling asleep lying on the bed for 15-20 minutes. Education and coaching on Energy conservation and work simplification strategies were incorporated in advising performance of various daytime activities.
7	ENVIRONMENTAL ADAPTATIONS	Suggestions and education on modifying noise, light, temperature and bedding, while in bed were explained.

First session was of 45-60 minutes where patients details were collected, scales were administered and depending upon the complaints customised intervention was planned.

First session included education regarding sleep hygiene measures, demonstration and practice of aerobic exercises, stretching exercises, relaxation techniques.

On second visit previous intervention was reviewed and practised. Then patient and therapist discussed strategies for fatigue management, routine management and energy conservation strategies.

In third week, the prescribed protocol was reviewed and continued. In last week on completion of intervention end assessment

Post intervention assessment was done to check out effectiveness of occupational therapy intervention.

Data was collected and analysis was done.

STATISTICAL ANALYSIS

All data were entered into a computer by giving coding system, proofed for entry errors

- Data obtained was compiled on a MS Office Excel Sheet (v 2019, Microsoft Redmond Campus, Redmond, Washington, United States).
- Data was subjected to statistical analysis using Statistical package for social sciences (SPSS v 26.0, IBM).
- Descriptive statistics like frequencies and percentage for categorical data, Mean & SD for numerical data has been depicted.
- ✓ Intra group comparison was done using Wilcoxon Signed rank test (up to 2 observations)

For all the statistical tests, $p<0.05$ was considered to be statistically significant, keeping α error at 5% and β error at 20%, thus giving a power to the study as 80%.

RESULT

Pre and post intervention intra group comparison was done using Wilcoxon Signed Ranks test. Intra group comparison of control group, pre and post intervention after four weeks showed significant difference at p value <0.05.

	N	Minimum	Maximum	Mean	Std. Deviation
AGE	37	29	60	52.95	7.838

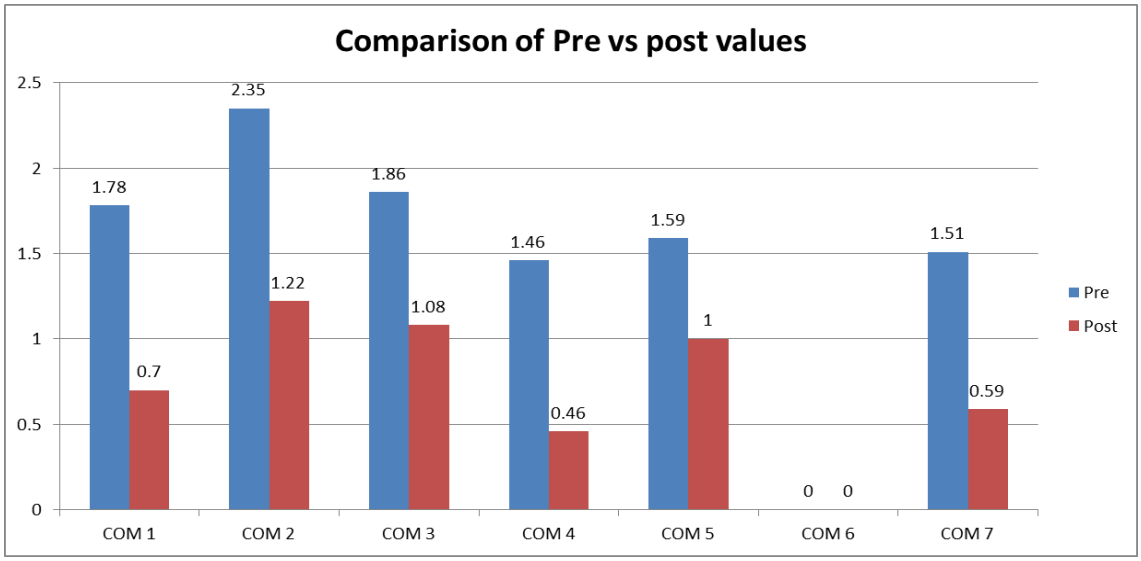
Table 1 showing distribution of age. The mean age of subjects was 52.95 years.

	Frequency	Percent
F	7	18.9
M	30	81.1
Total	37	100.0

Table 2 shows distribution of gender in the study. The data shows that there were 7 females and 30 males. The percentage of males (81.1) is more compared to females (18.9).

	Mean	Std. Deviation	Std. Error Mean	Mean diff	SD of diff	Median	Z value	p value of Wilcoxon Signed Ranks Test
Pre COM 1	1.78	.630	.104	1.081	.759	2	-4.886	0.000**
Post COM 1	.70	.618	.102			1		
Pre COM 2	2.35	.857	.141	1.135	.887	3	-4.622	0.000**
Post COM 2	1.22	.630	.104			1		
Pre COM 3	1.86	.822	.135	.784	.787	2	-4.158	0.000**
Post COM 3	1.08	.363	.060			1		
Pre COM 4	1.46	.960	.158	1.000	1.155	1	-3.999	0.000**
Post COM 4	.46	.505	.083			0		
Pre COM 5	1.59	.498	.082	.595	.498	2	-4.853	0.000**
Post COM 5	1.00	.236	.039			1		
Pre COM 6	.00[a]	.000	.000			0		
Post COM 6	.00[a]	.000	.000			0		
Pre COM 7	1.51	.731	.120	.919	.640	1	0.000	1.000#
Post COM 7	.59	.686	.113			1		

Table 3 shows the comparison pre and post intervention of the seven components of Pittsburgh Sleep quality index (PSQI). There is statistically significant improvement post intervention as scores reduced which indicates improved sleep quality. This finding is observed in first five components which are subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances. The component six use of sleep medication was not tested. The component seven daytime dysfunction showed improvement in scores but it was not statistically significant. ($p<0.05$)
** indicates highly significant.

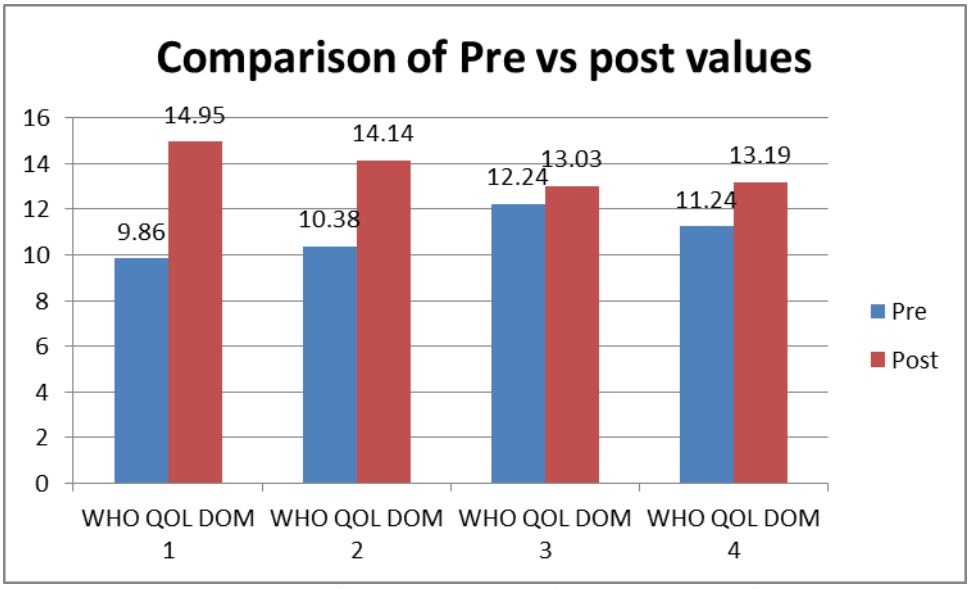


Graph 1 shows pre and post intervention mean differences in the values of 7 components of PSQI.

	Mean	Std. Deviation	Std. Error Mean	Mean diff	SD of diff	Median	Z value	p value of Wilcoxon Signed Ranks Test
WHO QOL PRE DOM 1	9.86	2.123	.349	-5.081	1.801	10	-5.258	0.000**
WHO QOL POST DOM 1	14.95	1.153	.190			15		

WHO QOL PRE DOM 2	10.38	1.977	.325	-3.757	1.935	10	-5.251	0.000**
WHO QOL POST DOM 2	14.14	1.159	.190			14		
WHO QOL PRE DOM 3	12.24	1.722	.283	-.784	1.548	12	-2.798	0.005**
WHO QOL POST DOM3	13.03	1.236	.203			13		
WHO QOL PRE DOM 4	11.24	2.165	.356	-1.946	1.332	11	-4.991	0.000**
WHO QOL POST DOM 4	13.19	1.450	.238			13		

Table 4 shows comparison of values of 4 domains of WHOQOL BREF Scale. The four domains physical, psychological, social and environment respectively showed statistically significant improvement after the end of four weeks intervention program.



Graph 2 shows pre and post intervention mean differences in the values of WHO QOL BREF of all the 4 domains. The comparison of pre-intervention and post intervention of WHO QOL BREF was analysed using Wilcoxon Signed Ranks Test

There was a statistically highly significant difference seen for the values between the time intervals ($p<0.01$) for all the 4 domains. It shows higher values post intervention in all the four domains of the scale. Higher the values suggest improved quality of life.

DISCUSSION

Sleep problems are addressed with all clients and framed from the perspective of health maintenance and health promotion. In occupational therapy theories, sleep is conceptualized as a restorative occupation with the goal of rest and recuperation, and good sleep and rest could support the formation of the occupation mix of self-care, work, and leisure during the day [32, 33]. The concepts of occupational balance focus on time use and suggest that the balance between rest/sleep and daytime activity is important in promoting function and well-being [34,35,36]. Sleep has a significant impact on functional performance in self-care, work, and leisure. Thus, sleep and daytime functioning are closely interrelated and excessive or insufficient sleep or daytime activities will contribute to occupational imbalance. [22]

There are several strengths of this study. First, the newly designed occupation-based sleep programme is more effective than the previous sleep hygiene programme. The current occupation-based programme does incorporate elements of sleep hygiene education, but also add elements of daytime activity engagement, and modification of sleep environment and lifestyle. The significant improvement in outcomes in the occupation-based programme could be the effect of these additional elements. This is based on the current PEOP (Person Environment Occupation Performance)

model and similar program was developed in the study carried out by Eris et al [11], Frazzitta et al [25] and Akbarfahimi et al [27].
Secondly in the past many studies considered use of one type of intervention and checked its effectiveness. In this study a combination of different types of interventions was used. Thirdly the program developed is based on newer ecological theories i.e. PEOP model. This model has been considered for OT'S role in sleep as given in review conducted by Eris et al. [22] And lastly the use of educational and coaching approach was used which involved an active role from the clients. These findings are in conjunction with a similar study which was carried out with patients diagnosed with multiple sclerosis. [27]
As previously stated, the intervention program in the present study was based on PEOP model. [22] Based on the PEOP framework, occupation-based sleep management can focus on three levels: (1) person: minimizing the influence of bodily function on sleep; (2) environment: promoting environment conducive to sleep; and (3) occupation: restructuring daytime activity. All the 3 aspects were considered and incorporated into the program. Regarding the first level, the individual person's physical (axial rigidity, muscle tightness, weakness and stiffness and other motor symptoms) aspects and the mental (thinking, frustration, irritability, fatigue and other mental components) aspects of the individual were considered. The targeted intervention was developed using aerobic exercises, stretching and relaxation. The second factor, the environment is addressed in treatment with the inclusion of accommodating patient's sleep area in order to eliminate disturbances. The occupation was addressed by restructuring the daytime activity and routine and establishing occupational balance. The subjects were educated about prioritizing the daytime ADL activities and accordingly schedule the day.
The aerobic exercises regime given in the first week which was followed-up for 4 weeks may have helped in improvement of sleep quality. The statistically significant results have been obtained post intervention in the sleep quality, duration, and latency and efficiency components of PSQI. The person with PD complains of sleep disturbances such as inability to take turns, to move limbs and increased muscle tension which leads to sleep fragmentation. These complain were managed by working on the personal factors of clients. The aerobic exercises, stretching program and relaxation given in this study as a part of intervention may have resolved these complains and showed significant improvement in reducing sleep disturbances. Results similar to this study were also derived by two studies, 1 an Randomised control trial (RCT) and 1 a non-Randomised control trial. They also explored the use of various exercises to reduce sleep disturbances in people with PD. Both found significant improvement and provide moderate strength of evidence for this type of intervention. The RCT examined a resistance training exercise intervention that resulted in significantly reduced sleep disturbance and improved sleep quality scores [37]. In the non-RCT, an individual exercise program using balance and coordination tasks, rhythmic exercises, resistance training, and aerobic circuits also significantly reduced sleep disturbances [38]. Another controlled trial showed significant improvement in subjective sleep quality, sleep efficiency, and total sleep time in PD patients assigned to high-intensity exercise training compared to non-exercise controls ($p < 0.01$). [28] Hence it supports that overall moderate-intensity exercise is shown to improve sleep-onset latency and sleep duration while promoting a feeling of restfulness and a better perception of sleep quality. [39, 40] The benefits of these can be extrapolated to improvement in subjective sleep quality and overall quality of life of PD patients. This study also included sleep hygiene measures. The use of sleep hygiene may have genuinely helped in improving subjective sleep quality and sleep latency domains of PSQI. Sleep hygiene education often adopts the preventive framework and

covers how substance use, sleep wake regularity, avoidance of daytime naps, and stress reduction methods may affect sleep. In fact, recent systematic reviews found that sleep hygiene programmes for insomnia are popular. Bloom et al. (2009) reports that sleep hygiene education is not sufficient enough to be used alone for the treatment of insomnia. [41] Based on the above findings, this study not considered sleep hygiene measures alone, but due to its proven benefits, it was used in conjunction with other OT related sleep specific interventions. The use of sleep hygiene measures was based on both client and occupation aspect of PEOP model. Relaxation was also one of the component of the sleep program in this study. Active relaxation technique was taught to the patient. It perhaps led to improved sleep quality. The use of relaxation technique is also observed in various studies with positive results. In a meta-analysis conducted by Nau et al in 2005 [42], it was stated that progressive muscle relaxation therapy was found to be moderately effective in inducing sleep. Both active and passive forms of relaxation methods appear to be effective in the treatment of sleep with improvements in sleep efficiency, sleep quality, and sleep-onset latency. Incorporating a program that provides support, tailored educational strategies, and effective sleep management techniques have resulted in promotion of healthy habits, improved sleep efficiency, increased total sleep time, while reducing sleep onset latency. The subjects enrolled were helped to structure their daytime routine, schedule the activities, and plan the day. The occupational balance was tried to achieve for each client. Despite of it, the last component of PSQI (daytime dysfunction) did not show statistically significant improvement maybe due to the complexity of sleep cycle and symptoms related to the disease process.

Another secondary outcome in this study was quality of life, which was improved in the subjects. Several studies documented that sleep problems are very common in patients with PD and severely impact on quality of life and also worsens the motor & non-motor symptoms. [24, 29, 38] The quality of life of patients enrolled in the current study also demonstrated low scores pre intervention. And post intervention the scores increased which is interpreted as improved quality of life. The improvement on scale was seen in all the 4 domains i. e. physical, psychological, social and environmental. This improvement could be due to the use multi-modal protocol. These intervention options were also found in multiple studies and have potentially reduced signs of tension, contribute to better sleep quality, and increased relaxation. [18, 26, 43] Improvement in the scores were also observed in the study conducted by D. Gill and p. They also reported physical activity contributes to all aspects of QoL-not just the physical. [44]

At the end it is significant to mention that the program yielded overall positive outcomes for patients with PD in both the areas i.e. sleep quality (study's primary outcome) and quality of life (the secondary outcome).

CONCLUSION

The present study demonstrated that occupational therapy based sleep intervention can improve sleep quality and quality of life in people with PD. The given intervention can be incorporated in the routine practice in rehabilitation. The implementation of this intervention can be done by occupational therapists working in multiple settings with people with PD.

Limitations:

The study had smaller duration of intervention. The long term effectiveness of this intervention was not assessed using long term follow-ups.

Future implications:

The present study has implications for both clinical practice and aspects of future research. The results of this study will help occupational therapists who work with patients diagnosed with PD and use interventions aimed at improving sleep quality, and ultimately improving overall

quality of life. It is also recommended that academic researchers pursuing research in this area conduct a study with a larger sample size in order to increase the generalizability of the results. Lastly, future studies should consider the incorporation of a long-term follow-up with the patients who received the intervention as well as the use of objective measures of sleep quality assessment.

Declaration by Authors

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