# Comparison of Combined and Conventional Rehabilitation with Virtual Monitoring Method on Impulsivity in Parkinson's Patients

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## Abstract

**Introduction:** Parkinson's disease is a chronic multisystem disease that can cause motor and non-motor symptoms and cognitive changes. One of the most important conservative treatments for Parkinson's disease is physiotherapy. Lack of simultaneous attention to the cognitive aspect of rehabilitation consistent with its physical aspect may be one of the effective reasons for the ineffectiveness of Parkinson's exercise therapy, which has not been considered before. Therefore, the purpose of this study was to compare the effect of fifteen sessions of combined rehabilitation (cognitive and exercise therapy) and conventional rehabilitation (exercise therapy) with virtual monitoring method on the impulsivity of Parkinson's patients. **Materials and Methods**: This pretest-posttest study had two groups of intervention. The patients were of both sexes and between 50 and 75 years old. The two groups of combined rehabilitation (n=32) and conventional rehabilitation (n=31) were examined for 15 sessions. Before and after the interventions, the level of impulsivity was determined by Barratt questionnaire. The method of measuring and monitoring the interventions in virtual space was designed and implemented. The scores obtained from the questionnaire were analyzed using SPSS 26 software. Mann-Whitney test was used to analyze the mean scores due to the abnormality of the variables. **Results**: The results showed that after 15 sessions of intervention, there was a significant difference between the two groups of samples in the impulsivity scores of unplanning and coping stability. Combined rehabilitation intervention (cognitive and exercise therapy) had a greater effect on patients' impulsivity than conventional rehabilitation (exercise therapy). **Conclusion**: Performing both combined and conventional rehabilitation interventions reduced the impulsivity of Parkinson's patients. However, in the group that received combined rehabilitation, the rate of this reduction was significant in most cases. Further interdisciplinary research between physiotherapy and cognitive rehabilitation is recommended, especially for neurological patients such as Parkinson's disease.

**Keywords:** Combined with Conventional Rehabilitation, Impulsivity; Parkinson, Virtual Monitoring Method

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## Introduction

Parkinson's disease is a chronic multi-system disease that can cause motor, non-motor, and cognitive changes (1). Parkinson's symptoms usually appear from the age of 50. According to the Parkinson's Foundation, men are 1.5 times more likely to be affected. There are currently more than 10 million people with Parkinson's disease worldwide. Parkinson's is the second most common neurological disease after Alzheimer (2).

Impulsivity, impulse control disorders (ICD), and hypomania are common non-motor features in Parkinson's disease (3, 4). Different aspects of human behavior including decision-making power, coping stability, and perseverance are effective in determining the degree of impulsivity that is a personality condition. Decision making and planning are high level cognitive functions. Impulsivity is a type of action without reflection or behavior whose cause is not properly evaluated. In 2019, the prevalence of impulsivity disorder in Parkinson's patients was reported to be 14% (5). Impulsivity is a tendency to react immediately and without planning to an external and internal stimulus, without paying attention to its individual and social effects and consequences that is dangerous for individuals. Unfortunately, impulsivity is clearly visible in the daily actions of a number of people in their daily lives (6). Impulsivity is a risk factor for many mental disorders and inefficiencies in life (such as a sudden change in personal and professional goals) (7).

Corona pandemic has affected many diseases, including Parkinson's. Suzler *et al*. (8) reported that while the role of the Covid virus 19 in the development or exacerbation of Parkinson's disease has not been established yet, but the aggravation of motor symptoms and certain immobility has been observed in patients with Parkinson's. Del Prete *et al*. has pointed to the increase in the anxiety of Parkinson's patients in the recent pandemic and the possibility of its association with the aggravation of motor symptoms (9). In fact, the nature of the pandemic is such that it exposes patients to constant and chronic stress. Home quarantine, reduced physical activity, and personal communication can exacerbate Parkinson's anxiety. Increased stress, in turn, may exacerbate impaired motor function in patients with Parkinson's disease and reduce the effectiveness of medications to treat the disease. Researchers also believe that exposure to stress can trigger latent Parkinson's disease (8, 10).

Using individual management strategies to cope with stress and increase adaptability, as well as increasing the physical activity of patients with Parkinson's in this critical situation, can play effective role in the treatment of these patients (11). Optimal management of these conditions requires a multidisciplinary team of health care professionals to work closely with the patient and their caregivers. The National Institutes of Health and Care excellence published updated guidelines on the management of Parkinson's disease in adults at 2017 (1).

Recently, rehabilitation therapies and the use of virtual reality have been described as an important way to overcome the limitations of conventional therapies for Parkinson's disease (12). One of the most important conservative treatments for Parkinson's is physiotherapy, especially, the area of exercise therapy that can be recommended and performed at home with virtual monitoring. In 2020, a review study was conducted to evaluate the efficacy and safety of therapies for Parkinson's disease with a review of eighteen studies (1,144 patients). Patients who received the exercise therapy showed a statistically significant improvement in the Berg Balance Scale, walking speed, and Timed Up and Go Test compared to patients who did not receive any treatment (13). Another meta-analysis was performed to assess the relative risk of serious and non-serious adverse events in patients treated with exercise compared to the non-exercise control group. Exercise increased the relative risk of non-serious side effects. Therefore, exercise therapy may be recommended as a relatively safe intervention (14).

In a careful evaluation of the cause of the contradiction in the above cases, it seems that the lack of simultaneous attention to the cognitive aspect of rehabilitation appropriate to its physical aspect (e.g. exercise therapy) may be one of the effective reasons for the ineffectiveness of Parkinson's exercise therapies. Therefore, the aim of the present study was to compare the effect of fifteen sessions of combined rehabilitation (cognitive and exercise therapy) and conventional rehabilitation (exercise therapy) with the method of virtual monitoring on the patients' impulsivity with Parkinson's disease.

## Materials and Methods

### *Design, samples, and sampling method*

This was a pre-test-post-test study with two intervention unblinded groups. The present study was population of Parkinson's patients who (according to medical records) referred to physiotherapy centers of Shahid Beheshti University of Medical Sciences during the last two years. After obtaining the necessary permits (code of ethics IR.SBMU.RETECH.REC.1396.637), these people were contacted by phone. First, the goals and methods were described. After emphasizing that due to the prevalence of corona virus, there was no need for people to leave their home, and also doing tests, prescribing exercises, and cognitive rehabilitation counseling were conducted using virtual space, and patients were invited to participate in the study with their satisfaction. Sampling method was convenient. Out of 87 contact numbers, 70 people announced their cooperation. Among them, 63 people who had the conditions to enter the study were selected and using a random number table were randomly allocated in two groups of combined rehabilitation intervention (cognitive and exercise therapy) and conventional rehabilitation (exercise therapy). Of these, 31 were in the combined rehabilitation group and the rest were in the conventional exercise therapy group. Inclusion criteria were having idiopathic Parkinson's disease with 2 -3 intensity degree with Hoehn-Yahr scale (15, 16), ability to walk 50 meters independently, ability to execute simple commands and age between 50 and 75 years. Exclusion criteria (based on the patient's own statements) included having any clinical conditions preventing activity physically, having sensory impairments (vision, hearing) to the extent that patients' gait was affected, and having dementia or acute cognitive problems.

### *Data collection tools and methods*

After finding Parkinson's patients with the conditions to enter the research and obtaining their consent, a Barratt questionnaire was sent to them in virtual space. Cognitive rehabilitation intervention

***Table 1.*** Demographic characteristics of two groups of Parkinson's patients before rehabilitation intervention

| Groups | Age (year) | Height (cm) | Weight (kg) | BMI | Sex | Level of Education |
|---|---|---|---|---|---|---|
| **Combined Rehabilitation Group (Cognitive and Exercise Therapy)** | 63.65±12.01 | 171.65±4.71 | 67.65±12.01 | 26.32±4.5 | 45% male | 30% university education |
| **Conventional Rehabilitation Group (Exercise Therapy)** | 66.29±10.04 | 167.25 ± 5.33 | 58.25 ± 8.01 | 24.32 ± 5.66 | 51% male | 41% university education |
| ***P*-value** | 0.08 | 0.13 | 0.06 | 0.11 | 0.08 | 0.14 |

***Table 2***. Assessing the differences between the two groups of Parkinson's patients before performing 15 sessions of rehabilitation intervention, impulsivity schemes, decision making, unplanning and coping stability (*$P$<0.05)

| Group / Variables | Combined Rehabilitation Group (Cognitive and Exercise Therapy) | | | Conventional Rehabilitation Group (Exercise Therapy) | | | *P*-value Between groups | |
|---|---|---|---|---|---|---|---|---|
| | Pre-intervention | Post-intervention | *P*-value | Pre-intervention | Post-intervention | *P*-value | Pre-intervention | Post-intervention |
| **Impulsivity of unplanning and coping stability** | 34.8±6.5 | 29.2±4.4 | 0.01* | 37.1±4.3 | 31.8±4.4 | 0.04* | 0.224 | *0.02 |
| **Decision impulsivity** | 27.1±4.9 | 23.4±4.2 | 0.04* | 25.1±7.2 | 24.4±5.6 | 0.05 | 0.153 | 0.07 |
| **General scale of impulsivity** | 61±14.6 | 52.2±11.2 | 0.03* | 62±14.6 | 57.2±11.2 | 0.07 | 0.06 | 0.06 |

was conducted in the form of phone calls to patient and exclusive counseling. Exercise therapy was similar for both groups and included stretch, flexibility, balance, and gait exercises trained to patient by video call and monitored repeatedly by the researcher's call. It lasted 35 minutes in each session and was performed five sessions per week for 15 sessions. At the end, the level of subjects' impulsivity was measured again with the Barratt questionnaire.

In this study, Barratt questionnaire was used to assess impulsivity. In this questionnaire, three components of impulsivity were distinguished: cognitive impulsivity (inability to focus on close work and cognitive instability (making quick decisions)), motor impulsivity (action without prior plan with difficulty), and unplanning impulsivity (inability to plan and think) (17). Ekhtiari *et al*. reported a Cronbach's alpha coefficient of 0.78 for cognitive impulsivity, 0.63 for motor impulsivity, 0.47 for unplanning impulsivity, and 0.83 for all items (6). The questionnaire contained 30 questions. Eleven questions were dedicated to motor impulsivity, 8 questions to cognitive impulsivity, and 11 questions to unplanned impulsivity. The total score of this questionnaire was 120, which was reported both as a general score and as a specific score. The higher the score, the more impulsivity it is (18).

Statistical analysis of the scores obtained from the questionnaire was performed using SPSS 26 software. Shapiro-Wilk test was used to check the normality of the data. In examining the normality of dependent variables, the findings showed that none of the dependent variables were normal ($P$<0.05). Therefore, Mann-Whitney non-parametric test was utilized to compare the mean scores of Parkinson's patients in each Barratt questionnaire for comparison between the two groups. Moreover, Wilcoxon signed-rank test was applied to compare changes within each group before and after the interventions.

# Results

The results of descriptive statistics of patients in the two groups are shown in Table 1. Before the intervention, no significant difference was observed between the two groups in the demographic variables (age, body mass index, gender, and level of education) ($P$>0.05). It should be also noted that there was no significant difference between the two groups in the parameters related to impulsivity between the two groups before the intervention ($P$<0.05).

As can be observed in Table 2, the comparison between the two groups after the intervention indicated that in group that underwent conventional exercise therapy rehabilitation, performing 15 sessions of intervention significantly reduced the unplanning and coping stability. In the group that

underwent combined rehabilitation, a significant decrease was observed in all three cases of impulsivity of unplanning and coping stability, decision impulsivity, and the overall scale of impulsivity between before and after the intervention. In comparison between two groups after the intervention, the Impulsivity of planning and coping stability was reduced in Combined Rehabilitation Group compared with Conventional Rehabilitation Group.

## Discussion

According to the results, it was observed that after 15 sessions, despite the fact that within both groups of interventions significantly reduced the Impulsivity of unplanning and coping stability, there was a significant reduction in the impulsivity scores of unplanning and coping stability in the combined rehabilitation group compared with conventional rehabilitation group after the interventions. It seems that the combined rehabilitation intervention (cognitive and exercise therapy) had a greater effect than conventional rehabilitation (exercise therapy) on reducing the patients' impulsivity. The rate of decision impulsivity did not change significantly between two groups after 15 sessions of intervention.

In the articles that have mentioned the relationship between Parkinson's and the present pandemic, isolating patients and increasing anxiety have been introduced as effective factors in mood disorders and impulsivity (3-7). In systematic review articles, the positive effects of physical exercise on general physical condition of patients with Parkinson's disease have been introduced. (12-14). On the other hand, exercise can be effective in reducing anxiety and consequently mood problems of patients (14, 16, 19). It is possible that the effect of reducing impulsivity in the combined rehabilitation group after 15 sessions of intervention in the present study was due to the effects of exercise therapy on the physical condition of patients with Parkinson's disease. Probably, the reason for the better therapeutic effect, which was seen in the reduction of overall impulsivity in the combined rehabilitation group compared to the conventional rehabilitation group, was due to the synergistic effect of Parkinson's patients' cognitive counseling on anxiety and indirect effect on reducing their impulsivity. Among the three components related to impulsivity, the most influential case in relation to environmental changes is impulsivity of unplanning and coping stability (3-7). The findings of the present study also confirmed this point because after 15 sessions of intervention, only a significant decrease was observed in this component of impulsivity. Because the social approach considers impulsivity as a learned behavior and caused by the environment, so by changing the environmental conditions, one can expect a decrease in impulsivity and thus improve decision-making, unplanning and coping stability (6).

On the other hand, in justifying the lack of significant change in the other two components of impulsivity between two groups in the present study, it can be pointed out that previous research has shown that cortical structures involved in decision making include orbital cortex, anterior cingulate cortex and posterior lateral frontal cortex, and the subcortical areas of the amygdala, thalamus, and cerebellum (8, 9, 12, 16, 19). The structures involved in planning are the forehead cortex and the basal ganglia, especially the striatum (20). The growth and maturation of the forehead cortex occurs in adulthood and is completed at the age of 25 (21). Improper performance of any of the mentioned components can lead to increase in decision impulsivity and impulsivity of unplanning and coping stability. Therefore, according to the patients' age in the present study, which was between 50 and 75 years, it is not far from the mind that for a positive effect on all components of impulsivity, combined interventions (cognitive and exercise therapy) are needed for a longer period of time. Of course, every step taken to improve the mood and physical condition of Parkinson's patients will be valuable.

Research limitations included the difficulty of engaging Parkinson's patients and monitoring exercises virtually. Recommendations for future studies include the implementation of longer-term interventions. Because impulsivity is a brain and behavioral characteristic of individuals, treatment over a long period of time can possibly affect all of the variables associated with impulsivity. In any case, more research is needed to reach a definitive conclusion.

## Conclusion

Based on the findings of the present study, it can be concluded that after 15 sessions of interventions, there was a significant reduction only in the impulsivity of unplanning and coping stability between the two groups of samples. It seems that combined rehabilitation intervention (cognitive and exercise therapy) has a greater effect than conventional rehabilitation (exercise therapy) on reducing patients' impulsivity.

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