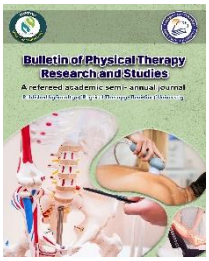
**Bulletin of Physical Therapy Research and Studies**

journal homepage: https://bptrs.journals.ekb.eg/

**ISSN: 2636-4190**



# Effect of physiotherapy on gait and balance for patients with Parkinson's disease: a review article.

**Ahmed A. El-Shanawany, PT, M.Sc.[1], Moshera Darwish, PT, PhD[2], and Shimaa Refaat, PT, PhD[3]**

[1]Ministry of Health, Egypt.
[2]Department of Physical Therapy for Neuromuscular Disorders and its Surgery, Faculty of Physical Therapy Cairo University, Egypt.
[3]Department of Physical Therapy for Pediatric Disorders and its Surgery, Faculty of Physical Therapy Cairo University, Egypt.

**Corresponding author:**

Ahmed A. El-Shanawany,

P.T., M.Sc., Ministry of Health, Egypt.
M.Sc. in Physical Therapy for Neuromuscular Disorders and its Surgery, Department of Physical Therapy for Neuromuscular Disorders and its Surgery, Faculty of Physical Therapy Cairo University, Egypt.

Email: ahmedelshanawany74@gmail.com

Tel: (+20)1002925246

DOI: **10.21608/BPTRS.2024.279839.1032**

**Running Title: Physiotherapy for gait and balance in Parkinson's disease**

## Abstract:

Parkinson's disease (PD) refers to a degenerative disease of the dopaminergic neurons of the substantia nigra pars compacta in the brain. It is considered a disabling disorder affecting many people. Its symptoms mainly include bradykinesia, rigidity, tremor, postural instability, and gait disability. Its effects are very wide covering large spectrum of people especially with old age. Its duration may last long years due to its degenerative nature. It has not only obvious and noxious motor manifestations, but also it has unmanifested disorders or dysfunctions including painful symptoms, depression, and the cognitive decline. All these features complete the whole image of disability in patients with PD. The most popular pathway is simply found in a slow fashion for most of patients. its effects causes the societies to suffer greatly with burdens in most sectors. Physiotherapy including excises and motor learning and training principles have good

effects in deterioration of symptoms and improvement of the whole condition. Future research should focus on the best treatment methods especially using technology, in the management of PD.

**Keywords**: Parkinson's, Balance, Gait, Motor training.

## Introduction

Parkinson’s disease (PD) is a global health challenge affecting many countries all over the world **[1].** It refers to a degenerative disease of the dopaminergic neurons of the substantia nigra pars compacta in the brain. It is considered a disabling disorder affecting many people. Its symptoms mainly include bradykinesia, rigidity, tremor, postural instability, and gait disability **[2].** There is usually destruction of about eighty percent of the dopaminergic neurons even before the presence of signs and symptoms which include non-motor symptoms such as autonomic dysfunction, cognitive, neuro-behavioral, and sleeping disorders **[2-4].** Regarding the treatment of PD, it was found that physiotherapy and rehabilitation are considered the gold standard treatment pathway in the management of PD **[5-7].**

## Prevalence

Parkinson’s disease is a very common disorder. It has critical effects on people's lives. It was found that, in 2016, about six million person were affected with this disorder **[8].** In the past twenty years, there was an increasing rate of PD prevalence. However, there is no definite cause standing behind this phenomenon **[8-10].** Parkinson’s disease effects are very wide covering large spectrum of people especially with old age. Its duration may last long years due to its degenerative nature. The most popular pathway is simply found in a slow fashion for most of patients. Due to all these affects, the societies suffer greatly with burdens in most sectors **[11, 12].**

Almost one million Americans have been diagnosed with PD. When compared to the total number of other diseases, such as Lou Gehrig disease, sclerosis, and muscular dystrophy, the ratio of Parkinson's disease (PD) is very high. Additional research has revealed that approximately 60,000 Americans receive a PD diagnosis annually.

However, compared to women, men receive PD diagnoses 1.5 times more frequently. In addition, the annual cost of treating PD in the US is approximately $2500, and the cost of a single therapeutic surgery can reach $100,000 **[13].**

According to additional analysis, the death rate from PD has risen by almost 63% in the US during the last 20 years. Conversely, other research has shown that the mortality ratio is based on several racial and ethnic groupings, urban/rural classifications, and both genders **[14].** Moreover, Marras et al. **[15]** has established that those with anxiety disorders or those who are exposed to dangerous substances in the United States are reported to have a heightened risk of PD.

## Causes and modifying factors

There are three main causes behind the presence of PD including genetics, environment, and interactions. Regarding the genetic factor, clinicians understand it to a great extent while the environmental one; there is difficulty assessing it due to the continuous changing behavior. There is a need for well-developed studies to assess and objectively measure the causes and factors of PD which will help finally in controlling them and management of the disorder **[12].**

## Clinical presentation

Parkinson's disease not only has obvious and noxious motor manifestations, but also it has unmanifested disorders or dysfunctions including painful symptoms, depression, and the cognitive decline. All these features complete the whole image of disability in patients with PD **[17].**

Regarding the diagnosis of PD, unfortunately, this process is very disappointing as there is a huge delay in the presence of symptoms after being affected with PD which in the best scenarios may be one decade **[18].** The first seen symptoms in most cases include constipation which is considered the most common feature, the rapid eye movement during sleep, hyposmia, asymmetric vague shoulder pain, and depression **[19].** There are many factors that may delay the presence of symptoms such as the absence of tremor,

when the patient legs are affected, or in patients with young age as compared to older ones **[20].**

## Physiotherapy

There many physiotherapy modalities that can be used efficiently in the management of PD. Recent guidelines support physiotherapy greater than other treatments such as pharmacological treatment. So, the evidence of using every strategy of physiotherapy represents a critical issue for physiotherapist to enable them treat patients well. However, physiotherapists dealing with patients with PD should have specific and intensive training based on the scientific approaches in the management of this disorder. This will decrease costs and save time effectively **[21-23].**

The main line of treatment that physiotherapist use in the treatment of PD comes from their usage of the abilities the patients with PD have to help decrease and control the motor disability as can as possible. In addition, this approach enabled patients to use and apply a specific and personnel treatment program which can increase and improve clinical outcomes **[24].**

One of the best treatment methods recommended by physiotherapists for the management of PD is the aerobic training. It comes on the top of pyramids of physiotherapy. It can control symptoms and improve the whole condition. Applying aerobic training in the form of treadmill walking combined with the virtual reality was found very effective and worth-while than aerobic training alone in terms of reducing falls and controlling balance **[25].** As for the intensity of training, it was found that programs with higher training intensities produce better clinical outcomes than those with lower intensity **[26].**

Many patients are usually unable to be adapted to a specific exercise program that best suit for their condition and dysfunctions especially when their treatment will last for long durations and sessions. So, the principle of the home training best suits for them on condition that they will have a physiotherapist that put, guide, and follow-up the progression of them. It was found that cycling 3 times/week on a stationary bicycle

improved the motor abilities greatly then stretching exercise that may, to a great extent, have many side effects **[27].**

## Balance and gait

Motor learning and training for patients with PD is considered the critical method in controlling the balance and gait instabilities. The program should be specific and well-prepared based on the condition of each patient which will result in extra-ordinary results regarding gait and balance. Physiotherapists should focus on the repetition principle and the specialty in choosing the exercises and training. There are some factors that must be covered during putting the training program for patients with PD including the intensity of training, the generalizability of this training to the tasks required for each patient, the extent of adaptability of this training to complex functions, and the critical factor; the affection and the external factors that may interfere and affect the results **[28].**

Motor learning and training to improve gait and balance for patients with PD should focus on the consistency of training including repeated sessions, exercises, and frequencies. This will help greatly and act as counteract to the degradations in the motor behavior found in most patients with PD as a result for the affection. Physiotherapy, and exercise mainly, was found effective in controlling the motor symptoms and improving the abilities to help patients live independently and efficiently during the activities of daily living or to a great extent during work **[28].**

Technology now plays an important role in designing and application of the physiotherapy programs to control balance and gait. Application of virtual reality was very effective in training patients with excellent clinical outcomes. In addition, usage of special sensors was found beneficial in the accurate assessment of the outcome measures and variables during training and also daily living. Technological elements represent the future for the patients with PD on condition that they have evidence and controlled side effects that may occur **[28, 29-32].**

## Repeated Perturbation Training

Balance and gait were effectively improved when managed by physiotherapy and exercise programs focusing on specific and feed forward practice. The falling rate was decreased to a great extent as compared to general programs. These results have focused on the principle of repeated perturbation training (RPT) as a method to decrease falling rate **[28]**.

Repletion brings extra-ordinary results especially when applied to the most situations or reactions causing fall to patients with PD. It can greatly improve their quality of life. Physiotherapist should take care of this training and control its system as can as possible to be safe and suitable for all patients especially with old age **[28]**.

Repeated perturbation training still lacks evidence regarding application of it using technological tools or devices. Well-developed trials are needed in this field of research. In addition, the parameters used including frequency, duration, etc., should be tested and proven. Many trials have tested RPT using platforms to alter patient's gait and balance. The results were promising and the patient's reactions were improving session after session **[28].**

Visser et al. **[33]** found that, with training, patients with PD show great control and improvement of balance and gait as detected by the surface EMG measures. The same results were found in van Ooteghem et al. **[34]** who used the platform in an oscillated manner at random amplitudes and showed that patients attempt to maintain balance during training. Patients were changing their reaction from feedback to feed forward strategies to main keep their balance during oscillatory perturbations.

**Factors affecting Motor Learning in Parkinson's Disease**

There are many factors that affect the motor learning and training to improve gait and balance for patients with PD. These factors include disease severity and its duration, disease classification whether it is a tremor dominant or postural instability and gait disability dominant, etc., degrees of degradation of neurons, and cognitive features. However, most of these factors need to be assed in future research. It was found that

motor learning worsens to a great extent in cases with disease severity. In addition, bad cognitive features result in delay in motor learning **[35-37].**

In patients with severe axial symptoms, it was found that motor learning worsens greatly in most of them **[38].** In addition, freezing of gait feature of PD seems to delay motor learning and the performance of motor learning tasks **[39].**

Laterality of symptoms of PD may also affect the motor learning process and its application in daily living or tasks; the left-onset PD is affected more than the right one **[40].** As for the progression of PD, it was found that motor learning is affected greatly in the early stages and on both sides **[41].**

## Prognosis

The progression of PD disease has different variations among patients especially the rate of case deterioration **[19].** The life expectancy decreases greatly as most of patients still having PD for many years reaching decades. The frequent causes that lead to death include aspiration pneumonia and complications post-hip fracture **[13].** There are predictions that may predict the progression of PD including lifestyle factors, coffee consumption, smoking, and physical activity **[42].** The neurological condition's course can be slowed down with an early identification of PD. Patients motor symptoms can also be managed with the use of cognitive exercises and strength training **[43].** Ultimately, containing a crisis, whether it stems from a fire or a virus, is the first step toward stopping its spread. We have not been able to control PD thus far. Rather, we are merely feeding it. The most crucial first step in combating the PD wave is prevention **[44].**

## Conclusion

The PD is very disabling disorder, it affects the quality of life to a great extent. The balance and gait instability interferes with the daily living and work. Old age patients are affected more than the younger and need special care and handling. Physiotherapy including excises and motor learning and training principles have good effects in deterioration of symptoms and improvement of the whole condition. Future research

should focus on the best treatment methods especially using technology, in the management of PD.

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