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PARKINSON DISEASE: ROLE OF ASSISTIVE TECHNOLOGY

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ABSTRACT

Among neuro-degenerative disorders, Parkinson's disease is the most prevalent affecting about 1% of adults older than 60 years.[1] It is characterized by clinical symptoms like rigidity, tremors, and bradykinesia (slowness of movement). The exact cause of PD is unknown, but according to several research studies, there are some genetic and environmental factors that contribute to the evaluation of PD, like the deficiency of dopamine in the basal ganglia, which is caused by the progressive loss of dopamine-producing neurons in the substantia nigra. After Alzheimer's it is the second most prevalent neurological disorder. Assistive technology is introduced to improve the daily living of the patients suffering from PD. Some examples of AT are hearing aids, medication, etc. This review article provides an overview of PD's pathophysiology, clinical symptoms, etiology, and assistive technology.

- **KEYWORDS**:- Parkinson's disease, Assistive Technology, pathophysiology, Symptom.

• INTRODUCTION

Parkinson's disease is a neurodegenerative disorder that gets worse over time. It affects about 1% of the population over age 50 years and about 2.5% of the population over age 70.[2]

The fundamental cause of PD is not yet determined, but several research studies suggest that it is triggered by a deficiency of dopamine-producing neurons in the substantia nigra. Individuals with PD may struggle to complete everyday tasks like walking, personal care, etc., and may lead to the need for assistance.

This review paper basically highlights the use of assistive technologies to make the lives of patients with Parkinson's disease easier, make them independent, and improve the quality of their lives. An assistive device is “any device or system that allows an individual to perform a task that they would otherwise be unable to do.” Assistive devices that go a step further and use technology in order to assist the user are known as assistive technology (AT).[3]

Assistive devices help them live life with more freedom and give them a sense of individuality to do their own chores. This contributes to both their physical and mental well-being.

Devicessuch as walkers, wheelchairs, shower chairs, voice devices, and no-slip mats play a crucial role in helping them and creating a big difference in their living; they are also important for their safety purpose. Devices like shower chairs, electric toothbrushes, and electric razors help them groom and bathe easily.

Walker and wheelchair also let them roam here and there easily and safely. Occupational therapists work with patients with Parkinson's disease to help them in daily life works, but these assistive technologies make work easy for them. Also, these technologies help patients increase their confidence and make them feel happy about themselves.

• UNDERSTANDING OF PD

The clinical syndrome known as Parkinsonism is characterized by bradykinesia, stiffness and tremor. The majority of specialists in the area believe that two of the three cardinal motor symptoms and a strong reaction to sufficient dosage of L- Dopa are necessary for the diagnosis of PD and to differentiate it from other cause of Parkinsonism (4). It is represented by the deah of nerve cells in the part of the brain known as the substantia nigra, which is responsible for producing the neurotransmitter dopamine.

CLINICAL SYMPTOM

• Major motor symptoms: T-R-A-P It stands for

1) TREMOR

Tremor represents the most common movement disorder with an overall prevalence of 14.5% in adults aged 50–89 years.[5] Rest tremor, a repetitive contraction and relaxation of muscles primarily on the limbs but also extending to the lips, chin and jaw, is one of the most immediately identifiable signs of PD. An outstretched horizontal position against gravity,

known as postural tremor has also reported in PD patient. Compare to rest tremor, postural tremor is more noticeable and may be one of the initial symptoms of PD.[6]

2) RIGIDITY

Rigidity is associated with a feeling of stiffness experienced by the patient, and clinicians may assess rigidity by examining the resistance of a muscle against passive stretching.[7] This rigidity causes pain and discomfort in the affected limbs.

3) BRADYKINESIA

- It does not refer to complete immobiliity; rather, it describe the incapacity to start motions..

“According to Marsden, bradykinesia is slowness of speed, which describes the most common clinical symptom. in PD best[8] Individuals with bradykinesia may struggle to perform daily life tasks such as dressing and grooming.

4) POSTURAL INSTABILITY

One of the symptoms of PD that is least responsive to medication treatment is postural inability, which is typically a late manifestation. Due to abnormal posture, patients are unable to catch themselves and fall frequently. To help with balance, Assistive devices could be required.[9]

• Non-motor symptoms of PD include

1) Cognitive impairment

2) Depression

3) Sleep disturbances

4) Weight loss

5) Sensory symptoms

PATHOPHYSIOLOGY

Lewy bodies in the dopaminergic neurons and a progressive loss of dopamine-producing neurons in the basal ganglia, especially in the substantia nigra, are hallmarks of Parkinson disease. Parkinson disease's pathologic characteristic is Lewy bodies. Parkinson disease, however, is a disease syndrome with various clinical subgroups since Lewy bodies are not unique to it and are present in a variety of neurodegenerative illnesses.[10]

ASSISTIVE TECHNOLOGY

Certain tasks may get harder as Parkinson's disease (PD) worsens. Assistive technology and adaptive tools are modern technologies made to aid everyday living. They can promote independence, function, and well-being.[11] AT can provide support, stability, and help for individuals to facilitate communication, recalls things that they can't remember due to PD, and manage everyday tasks.

While there are currently no treatments for this neurodegenerative process, PD patients' quality of life can be improved by certain treatments. However, assistive devices are typically advised for improving PD when pharmaceutical treatment proves insufficient as the condition becomes worse. The goals of these PD assistive devices are to help patients feel more independent, secure, and confident for as long as feasible. Depending on various clinical procedures and healthcare systems, different assistive device prescriptions may apply.[12]

According to standard guidelines, only certain experts, like neurologists, occupational therapists, or physical therapists, should prescribe the assistive technology to different patients, based on their individual needs and circumstances. This personalized approach ensures that each patient receives the most appropriate support, ultimately enhancing their quality of life and promoting greater autonomy in daily activities.[13]

TYPES OF ASSISTIVE TECHNOLOGIES - In Parkinson's disease, mobility is significantly affected due to the loss of dopamine-producing brain cells, as it leads to damage in the brain. It leads to mobility-related issues like slowed movements and difficulty in balancing, which majorly impacts standing in one place, walking, and other everyday activities.

To improve patients mobility-related issues, there are certain mobility aid devices that we can use.

1. Walking aids—For selecting a walking aid, we have to see the height of the patient, as the height needs to support a proper posture. Straight canes work better for people with PD than tripod or quad canes.[14]

For walkers, four-wheeled walkers offer better stability for people with PD rather than those that need to be lifted. For people with late-stage PD, a wheelchair or electric scooter might be needed to get around.[14]

Car handle grab For those who have difficulty getting in and out of the car (also called "transferring"), a handlebar can be used. This small, portable, easily storable device has a metal hook attached to a non-slip handle. To get in or out of the car.[15]

Walking poles can provide balance and help them maintain a better posture, especially for people with balance or walking changes or stooped posture. They also encourage larger movement patterns to overcome the smaller, shuffling walking pattern that some people have. Normally they range from $15 to $40.[15]

A laser cane is a single-point cane with a laser attachment that projects a red line in front of the user when the cane is touching the ground. For individuals who experience freezing of gait, the laser is used as a visual cue to guide the user on where to step.[15] It may cost up to $200.[16]

Walkers and wheelchairs are also very significantly used for PD patients for mobility purposes; they can be manual and fully automatic or semi-automatic. Standard walkers range from $40 to $90, whereas more advanced models can cost up to $300. Manual wheelchairs can cost from $150 to $500; other smart wheelchairs can cost $800 to several thousand dollars depending on their features and capabilities.

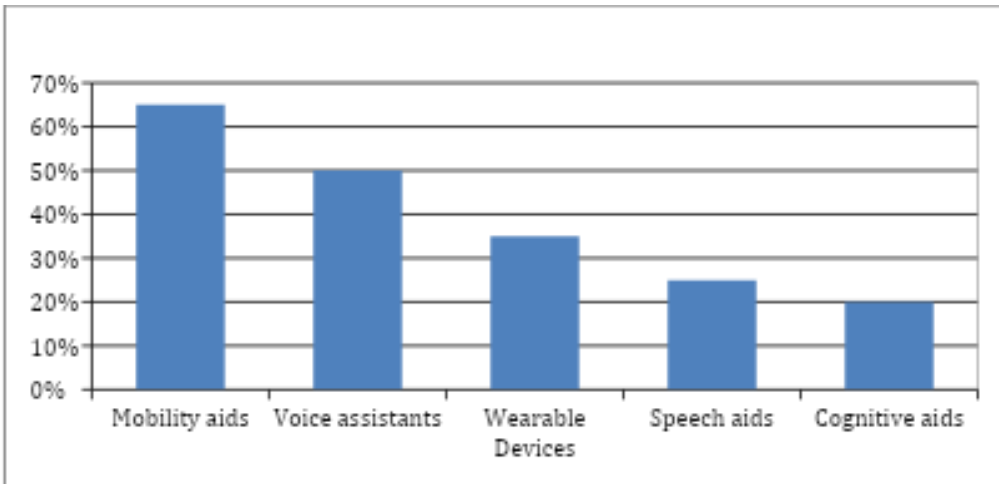
Other Personal aids which are used for betterment of PD patients are
The innovation and invention of a very smart assistive rehabilitation device have been accomplished. This device is called SGRD, short for Smart Glove Rehabilitation Device. Users are able to control and monitor the system with an IoT implementation interfaced with soft pneumatic actuators. This way, the bending of motion of the soft actuators helps the user in action-orienting their fingers. In addition, the smarts assistive rehabilitation device enhances productivity for the users. The stability and efficiency of the device make it safe for daily use.[17]

Dressing-Getting dressed can be difficult due to PD, especially when it comes to fastening buttons, zippers, and putting on shoes. Assistive devices that may help include: Magnetic buttons – MagnaReady offers dress shirts featuring external buttons that close with internal magnets. Shoes designed with Velcro or elastic laces are simpler to secure than traditional shoelaces.[18,19] To assist individuals with PD when using tubs and showers, bars or handrails can be installed to facilitate entry and exit. The use of non-slip mats or decals is also effective

in reducing the chances of slipping. Electric toothbrushes and electric razors simplify daily grooming tasks, and installing touch faucets can help since they activate with just a gentle touch when handling faucets becomes challenging.[20,21]

The Liftware Spoon uses stabilizing technology to spilling of food due to tremors while patients eat. In a clinical trials,it cancelled out 75 Percent of tremors.[15]

Smartphone applications are also used to record the patients' mood, emotions and even to record the dosage or medicines. Additionally, the screen of the smartphone can be used to record handwriting, the microphone to record speech samples, and the camera to record patient movements.[22]



Examples of assistive technologies.

HEARING AIDS	• Signalling devices • Circular system
MOBILITY AIDS	• Automatic Wheelchair • Laser canes
WRITING AIDS	• Enlarged keys keyboard • Word Processor
COMMUNICATION AIDS	• Voice Output Devices • Picture exchange system
VISUAL AIDS	• Screen Reader • Electronic Magnifier
PHYSICAL AIDS	• Non – slip surface

• MAJOR CHALLENGES

Although assistive technology is very helpful, everything that has advantages will also have some challenges.

This paragraph highlights the major challenges of assistive technology in

Parkinson's disease

Firstly, while there is a significant need, the level of demand remains low, primarily due to a widespread lack of awareness among potential users, their caregivers, and healthcare providers. Secondly, product designs do not adequately take into account the preferences and environments of users and caregivers, and the transfer of technologies to low-resource areas is limited. Thirdly, supply challenges include poor production quality, financial limitations, and a lack of trained personnel. Lastly, there is a shortage of robust evidence regarding the effectiveness of various types of technology.[23]

For example

70 million people need a wheelchair but only 5–15% have access to one, and production of hearing aids meets only 10% of global need and 3% of the need in low- and middle-income countries. Moreover, 200 million people with low vision do not have access to spectacles or other low-vision devices.[23]

In a Canadian study, approximately 30% of people older than 65 years and 50% of people older than 85 years living in the community had experienced a fall at least once a year.[24]

The United States of America (USA), an estimated 40% of those aged 65 years or older living at home will fall at least once each year, and about one in 40 of them will be hospitalized.[25] of those admitted to hospital after a fall, only about half will be alive a year later.

Cost is a significant obstacle in low- and middle-income countries where there is insufficient investment by governments in the delivery of services and in the training of personnel. There is a lack of substantial evidence demonstrating that assistive technologies enhance users' functioning. Addressing this issue necessitates efforts from the scientific community, research and development organizations, and the manufacturing industry to close these gaps through collaboration with prospective beneficiaries and, when applicable, their caregivers.[26]

• **COMPARISON OF ASSISTIVE TECHNOLOGY AND MEDICINE IN PARKINSON'S DISEASE**

- Medicines like levodopa, dopamine agonists, MAO-B inhibitors, etc., focus on managing the symptoms by increasing dopamine levels, whereas assistive technology like hearing aids, memory aids, etc., helps the patient to perform everyday tasks easily and independently.
- Medicine is highly effective in the beginning to middle phase; it may lose its effectiveness over time, while AT is useful at all phases.
- Medicines can cause nausea, hallucinations, and dizziness, while AT has either very few or no side effects.
- A patient may depend upon the use of medication for a lifetime, while in AT it is used as needed, & dependency can be reduced by caretakers.
- Due to lifelong use of medication, medicines are quite expensive, while in AT it could be expensive initially, but long-term benefits are significant.
- Daily living assistance - medicine do not have a direct impact on major difficulties such as eating, dressing, and writing, while in AT, no slip mat and automatic brush make tasks easier.

For best results we can combine both medicines and assistive technology together. In the early phase, medicine plays a vital role in managing PD, while in the middle phase, both of them are helpful, but in the late phase of PD, assistive technology becomes more useful as medicine's effect declines.

CONCLUSION

As Parkinson’s disease (PD) advances, certain activities might become increasingly challenging. Adaptive tools and assistive technology—creative devices aimed at enhancing everyday life—can improve functionality and wellbeing, as well as support ongoing independence. Wearable technology can offer relevant, factual, precise, and ongoing health information that is less susceptible to personal interpretation. Ultimately, these methods will address the limitations associated with single or multiple “snapshot” evaluations prevalent in current clinical practice and research focused on healthcare. Designers of wearable devices must recognize the variability of symptoms in Parkinson's disease and the distinct needs of users. Special attention should be paid to health challenges related to Parkinson's disease and the users’ familiarity with technology.[27] This review highlights the wide range of AT into the Parkinson's disease including wearable gadgets, communication devices, mobility aids

etc. It addressed various advantages such as stability, greater independence, improved quality of life, greater independence.

REFERENCES

1. Samii A, Nutt JG, Ransom BR. Parkinson's disease. The Lancet., 2004 May 29; 363(9423): 1783–93.
2. Marvanova M. Introduction to Parkinson disease (PD) and its complications. Ment Health Clin., 2016 Aug 31; 6(5): 229–35.
3. Cunningham LM, Nugent CD, Finlay DD, Moore G, Craig D. A review of assistive technologies for people with Parkinson's disease. Technol Health Care Off J Eur Soc Eng Med., 2009; 17(3): 269–79.
4. Colcher A, Simuni T. CLINICAL MANIFESTATIONS OF PARKINSON'S DISEASE. Med Clin North Am., 1999 Mar 1; 83(2): 327–47.
5. Bhidayasiri R, Maytharakcheep S, Phumphid S, Maetzler W. Improving functional disability in patients with tremor: A clinical perspective of the efficacies, considerations, and challenges of assistive technology. J Neurol Sci., 2022 Apr 15; 435: 120197.
6. Váradi C. Clinical Features of Parkinson's Disease: The Evolution of Critical Symptoms. Biology, 2020 May; 9(5): 103.
7. Moustafa AA, Chakravarthy S, Phillips JR, Gupta A, Keri S, Polner B, et al. Motor symptoms in Parkinson's disease: A unified framework. Neurosci Biobehav Rev., 2016 Sep 1; 68: 727–40.
8. Reichmann H. Clinical criteria for the diagnosis of Parkinson's disease. Neurodegener Dis., 2010; 7(5): 284–90.
9. Colcher A, Simuni T. CLINICAL MANIFESTATIONS OF PARKINSON'S DISEASE. Med Clin North Am., 1999 Mar 1; 83(2): 327–47.
10. Parkinson Disease | AAFP [Internet]. [cited 2025 Apr 4]. Available from: https://www.aafp.org/pubs/afp/issues/2020/1201/p679.html
11. Assistive Technology & Devices | Parkinson's Foundation [Internet]. [cited 2025 Apr 4]. Available from: https://www.parkinson.org/living-with-parkinsons/management/activities-daily-living/assistive-tech-devices
12. Assistive Devices for Personal Mobility in Parkinson's Disease: A Systematic Review of the Literature - García-Bustillo - 2022 - Movement Disorders Clinical Practice - Wiley Online Library [Internet]. [cited 2025 Apr 4]. Available from: https://movementdisorders.onlinelibrary.wiley.com/doi/full/10.1002/mdc3.13568

13. Constantinescu R, Leonard C, Deeley C, Kurlan R. Assistive devices for gait in Parkinson's disease. Parkinsonism Relat Disord., 2007 Apr; 13(3): 133–8.
14. Assistive Devices for Parkinson's Disease [Internet]. [cited 2025 Apr 7]. Available from: https://parkinsonsdisease.net/living-with-pd/assistive-devices
15. Pringle K, Lau S. In the Community: Assistive Devices for People with Parkinson's Disease | Parkinson's Disease [Internet]. 2023 [cited 2025 Apr 7]. Available from: https://www.michaeljfox.org/news/community-assistive-devices-people-parkinsons-disease
16. Assistive Devices for Parkinson's Patients: Enhancing Mobility and Independence [Internet]. [cited 2025 Apr 7]. Available from: https://www.ewmotiontherapy.com/blog/assistive-devices-parkinsons
17. (PDF) Development of Smart Glove Rehabilitation Device (SGRD) for Parkinson's Disease. ResearchGate [Internet]. 2024 Oct 22 [cited 2025 Apr 7]; Available from: https://www.researchgate.net/publication/346306014_Development_of_Smart_Glove_Rehabilitation_Device_SGRD_for_Parkinson's_Disease
18. Read ET 3 min. ParkinsonsDisease.net. [cited 2025 Apr 7]. Assistive Devices for Parkinson's Disease. Available from: https://parkinsonsdisease.net/living-with-pd/assistive-devices
19. Assistive Devices, Therapies & Techniques [Internet]. Essential Tremor. [cited 2025 Apr 7]. Available from: https://essentialtremor.org/resource/assistive-devices/
20. National Resource Center on Supportive Housing and Home Modifications - Mid-Atlantic ADA Center [Internet]. [cited 2025 Apr 7]. Available from: https://www.adainfo.org/resources/national-resource-center-supportive-housing-and-home-modifications/
21. Pringle K, Lau S. In the Community: Assistive Devices for People with Parkinson's Disease | Parkinson's Disease [Internet]. 2023 [cited 2025 Apr 7]. Available from: https://www.michaeljfox.org/news/community-assistive-devices-people-parkinsons disease
22. Deb R, Bhat G, An S, Shill H, Ogras UY. Trends in Technology Usage for Parkinson's Disease Assessment: A Systematic Review [Internet]. medRxiv; 2021 [cited 2025 Apr 7]. p. 2021; 02(01): 21250939. Available from: https://www.medrxiv.org/content/10.1101/2021.02.01.21250939v1
23. WHO South-East Asia Journal of Public Health [Internet]. [cited 2025 Apr 4]. Available from:

https://journals.lww.com/wsep/fulltext/2018/07020/improving_access_to_assistive_technologies_.6.aspx

24. Medical Advisory Secretariat. Prevention of falls and fall-related injuries in community-dwelling seniors: an evidence-based analysis. Ont Health Technol Assess Ser., 2008; 8(2): 1–78.
25. Rubenstein LZ. Falls in older people: epidemiology, risk factors and strategies for prevention. Age Ageing, 2006 Sep; 35(l): 2: 37–41.
26. Improving access to assistive technology.
27. JMIR Formative Research - The Views and Needs of People With Parkinson Disease Regarding Wearable Devices for Disease Monitoring: Mixed Methods Exploration [Internet]. [cited 2025 Apr 7]. Available from: https://formative.jmir.org/2022/1/e27418