Wearable Devices: How Technology Helps People with Parkinson's Disease

By Terry Ann Donner, RN, JD, CCM, CSA

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Parkinson's disease has become the second most diagnosed neurodegenerative disease. The onset of this devastating condition is subtle, marked by tremors, muscle rigidity and problems with gait. New wearable devices designed to detect and monitor the progression of Parkinson's disease may help your physician adjust your medications and treatment plan to optimize your care.

Key takeaways:

- Wearable medical devices will allow real time measurement of movement symptoms so that your neurologist can monitor the effectiveness of your prescribed medications.
- Most wearable devices that have been approved by the FDA for use with patients are not covered by Medicare, Medicaid or private insurance.
- Wearable device technology is not yet being used on a widespread basis by neurologists and other physicians in treatment of Parkinson's disease.

What is Parkinson's disease?

Approximately 1 million people have been diagnosed with Parkinson's disease in the United States. The onset of Parkinson's disease symptoms is usually slow. It may start with a tremor in your hand, slowed movement of your limbs or muscle stiffness. In the early stages, your speech may become soft, monotone or slurred, your face may stop showing expression or your arms may not swing naturally when you walk.

Parkinson's disease creates a significant number of **motor, cognitive, psychiatric and non-motor symptoms**. Symptoms often begin on one side of your body and remain worse on that side. Tremors usually begin in your fingers or hand. You find yourself rubbing your finger and thumb together in a "pill rolling" motion. The tremor occurs at rest. It may decrease when you use your hand or fingers to perform a task.

Another classic symptom of Parkinson's disease is bradykinesia, also known as slow movement. Tasks take longer, you **may shuffle or drag your feet** and your steps become shorter, increasing the risk of falling. There may be balance issues as your Parkinson's disease stoops your posture. This is complicated by muscle stiffness and rigidity, which can be painful and interfere with balance.

There will be a noticeable change in your handwriting which often becomes difficult or smaller. Eventually, Parkinson's Disease **may result in depression, urinary incontinence, difficulty sleeping, sexual dysfunction and dementia.**

Causes of Parkinson's disease

Parkinson's Disease is the result of **the loss of nerve cells in the substantia nigra of the brain.** The cells in this area produce dopamine. Dopamine serves as a messenger between the brain and nervous system, controlling body movements. As the amount of dopamine secretion is reduced with cell loss, movements become slow and uncoordinated. It is not known why these nerve cells die in Parkinson's disease. A combination of genetics and environmental factors are cited as causes.

What treatment options are available?

There is no cure for Parkinson's Disease. However, **medications may improve your symptoms** and help maintain your independence. Patients with Parkinson's disease are prescribed levodopa, which is used by the body's nerve cells to make dopamine. Levodopa is usually taken with another medication, carbodopa, to reduce some of its unpleasant side effects like nausea and vomiting.

Other medications include enzyme inhibitors to slow the enzymes that break down dopamine in the brain, amantadine to decrease involuntary movements and anticholinergic medications to decrease muscle stiffness and tremors. For medication therapy to be successful, **it is important for the neurologist to know the**

patient's response to the medication at the dose ordered.

Difficulties in treating Parkinson's

Developing a treatment plan is difficult as the patient is seen only once every few months for a short time in the clinic or neurologist's office. The neurologist must rely on patient or family recall or a patient diary of how symptoms respond to the medication dose ordered. This history is not always accurate.

In addition, **keeping written records can be time consuming and exhausting for a patient** who has difficulty writing or is experiencing muscle rigidity or cognitive issues. The neurologist usually does not see the patient's true symptoms in the office because the patient often takes his or her medication just before the appointment.

It is hoped that **wearable devices will help the doctor monitor the patient's response to the medications and actual symptoms,** so the treatment plan can be truly individualized.

Wearable devices for Parkinson's disease

Wearable sensors, eDiaries and electronic rating scales help patients monitor their symptoms in their own homes. It is very important to be able to see how the **patient moves and operates in the home setting on a daily basis, rather than on one isolated**

clinic visit. This will make medication adjustments much more effective, especially when the time the medication is taken is recorded by the device that is also sensing and reporting the muscle movements.

There are many researchers in the academic and commercial worlds working to bring more of these new wearable devices to market. Wearable devices allow the recording of evidence of the effectiveness and duration of the impact of medication on motor skills in the environment in which the patient lives and functions. Wearable devices make symptom **monitoring real time, long-term and objective.**

The reasons these devices are being developed include:

1. **Diagnosis**. The ability to detect subtle symptoms and make an earlier diagnosis.
2. **Symptoms**. Allow monitoring of symptoms in the home environment to make medication adjustment more effective.
3. **Compliance**. Encourage compliance with the inclusion of an exercise program component in the patient's at home care plan.
4. **Outcomes.** Improve the outcomes of clinical trials where the effectiveness of proposed new medications can be monitored more objectively in real time. Wearable devices are portable and can be worn on the body or clothing.

One exciting potential use of wearable devices has to do with falls, which go hand in hand with motor dysfunctions. Wearing a portable device that can identify a gait or balance issue in real time and provide feedback to the patient, via a visual, auditory or touch based feedback system, may help a patient adjust his or her gait and avoid the fall. These devices will also allow neurologists to manage motor symptoms with more accurate medication prescribing.

How to they work?

The devices include sensors that can be **placed on the arm, leg or chest, smart watches, smart clothes, pressure shoes or smart glasses.** They contain special technology that enables the doctor to analyze the patient's motion in real time. The sensitivity of these devices allows small changes in motion to be detected. Designed to be worn over time, the wearable device can provide the doctor with a more accurate picture of the patient's symptoms. This ultimately optimizes the treatment plan that is prescribed.

However, **few health care practitioners use wearable sensors** in their practices. If they do, they use them for short term assessment prior to an office visit. A box with the sensor and instructions is mailed to the patient, who applies the sensor and wears it for a week prior to the appointment.

Data from the sensor worn at home is collected and uploaded to the cloud, sometimes via the use of smart phone apps. This data is then extracted, analyzed and submitted to the

neurologist for evaluation. The patient appointment is used to examine the patient, discuss the data, any new symptoms or issues, and to create an individualized treatment plan that best fits his or her symptoms.

Are wearable devices approved by the FDA?

Yes, a number of **symptom-monitoring smart watch applications have been approved by the FDA.** The FDA has also approved several wrist-worn devices that are designed to reduce tremors. The Cala Trio is FDA approved and calibrated to the patient's unique pattern of brain signals.

The manufacturer of the Cala Trio asserts that it stimulates the surface of the wrist to interrupt the tremor network in the brain that causes tremors of the hand. It requires a prescription from the doctor.

Most of these **wearable devices are not covered by insurance**. However, some manufacturers will offer financial assistance.

Wearable devices are a new frontier in Parkinson's disease. The technology can be used to diagnose Parkinson's disease earlier, monitor symptoms, help manage medications and potentially manage other risks associated with gait and balance disturbances, such as falls. If you are interested in using any of the devices that have been cleared by the FDA, you should contact your neurologist's office to ask if he or she is using any of the wearable devices and will prescribe one for you.

Resources:

1. A New Paradigm in Parkinson's Disease Evaluation With Wearable Medical Devices: A Review of STAT-ON.

2. Incidence of Parkinson's Disease in North America.