Neuroprotective Benefits of Exercise

What role does exercise play in the management of PD?

Exercise is an important part of healthy living for everyone. However, for people with PD exercise is not only healthy, but a vital component to maintaining balance, mobility and daily living activities. NPF is studying exercise in the Quality Improvement Initiative. Every center agrees that they believe exercise is important to good outcomes in PD, and the data supports that. Doing exercise is associated with a better sense of well being, even across stages and severity of the disease. This was expected: there is a growing consensus amongst researchers about the short- and long-term benefits of exercise for people with PD.

Exercise can benefit in two ways:

1. **Symptom management.** Research has shown that exercise can improve gait, balance, tremor, flexibility, grip strength and motor coordination. Exercise such as treadmill training and biking have all been shown to benefit, as has tai chi and yoga (although more studies are needed).

2. **Possibly slowing disease progression.** There is a strong consensus among physicians and physical therapists that improved mobility decreases the risk of falls and some other complications of Parkinson’s. They agree that practicing movement—physical therapy, occupational therapy, and participating in an exercise program—improves mobility. By avoiding complications, you can avoid some of the things that can make PD worse. Beyond this, we know that people who exercise intensely, for example by doing things like running or riding a bicycle, have fewer changes in their brains caused by aging. Studies in animals suggest that Parkinson's disease is also improved by exercise. Many neurologists in the NPF Center of Excellence network recommend intense exercise to their patients and also to people who are worried about getting PD because of a family connection. One neurologist told us that he tells
people with a relative who has PD to exercise 300 minutes a week, with at least half of it intense running or bike riding.

How can I benefit from exercise?

- The best way to achieve these benefits is to exercise on a consistent basis. People with Parkinson's enrolled in exercise programs with durations longer than six months, regardless of exercise intensity, have shown significant gains in functional balance and mobility as compared to programs of only two-week or ten-week durations.
- However, when it comes to exercise and PD, greater intensity equals greater benefits. Experts recommend that people with Parkinson's, particularly young onset or those in the early stages, exercise with intensity for as long as possible as often as possible. Your doctor might recommend an hour a day three or four times a week, but most researchers think that the more you do, the more you benefit.
- Intense exercise is exercise that raises your heart rate and makes you breathe heavily. Studies have focused on running and bicycle riding, but experts feel that other intense exercise should provide the same benefit.
- Regardless of your condition, you should always warm up and cool down properly, exercise in a way that is safe for you, and know your limits. There are many support groups, therapists, and exercise programs who can help with PD-safe exercise and help you to set up your own program if that’s what works best for you. Be sure to consult your physician. If your physician is not a PD expert, you can call the NPF helpline (1-800-4PD-INFO) to help you to explain to your physician the importance of exercise so that you and your doctor can put together a plan that will work for you.

How does exercise change the brain?

What happens in the brain to produce these visible benefits? Researchers at the University of Southern California (Fisher et al.) looked at the brains of the mice that had exercised under conditions parallel to a human treadmill study. They found that:

- Exercising changed neither the amount of dopamine nor the amount of neurons in the animals' brains.
- But in the ones that had exercised, the brain cells were using dopamine more efficiently.
- They also found that exercise improves that efficiency by modifying the areas of the brain where dopamine signals are received — the substantia nigra and basal ganglia.

Scientists at University of Pittsburgh found that in animal models, exercise induces and increases the beneficial neurotrophic factors, particularly GDNF (glial-derived neurotrophic factor), which reduces the vulnerability of dopamine neurons to damage.

At the molecular level, at least two things are happening to make dopamine use more efficient:

1. Dopamine travels across a space between two adjacent brain cells called a synapse. This process is called signaling and it is essential for normal functioning. To end the signal, a protein complex called the dopamine transporter normally retrieves dopamine from the synapse. The first thing Fisher et al. found is that animals that had exercised
possessed less of the dopamine transporter, meaning that dopamine stayed in their synapses longer, and their dopamine signals lasted longer.

2. Secondly, they found that the cells receiving the dopamine signal had more places for the dopamine to bind in animals that exercised, and so could receive a stronger signal. This binding site is called the D2 receptor.

3. They also studied the D2 receptor in a subset of the human subjects who were within one year of diagnosis and not on any medications, using the imaging technique known as positron emission tomography (PET). They found that in humans, too, exercise increased the number of D2 receptors.

What kinds of exercise are helpful for people with PD?

- Any exercise will be beneficial. Be sure to check out the tip sheet on exercises specifically helpful for people with PD.
- It is important to consult with your physician and, if available, a physical therapist that understands PD, but anything you do without injuring yourself will provide a benefit.
- Formal exercise programs balance several different fitness criteria: strength, balance and coordination, flexibility, and endurance.
- Each of these areas has been demonstrated to provide a benefit to people with PD, and none should be ignored. Achieving a balance that works for you and that engages you in a program that you can keep start, maintain, and, hopefully, expand upon is the goal.

Many programs target the rapid gains that can be achieved through a focus on improvements in functional capacity and mobility. These programs vary according component activities. Examples of exercise programs for people with PD include:

- Intensive sports training
- Treadmill training with body weight support
- Resistance training
- Aerobic exercise
- Alternative forms of exercise (Yoga)
- Home-based exercise (workout tapes)
- Practice of movement strategies

Working with a Partner

- Many people find that they achieve the most success when they work with a partner.
- Depending on the stage of the disease, it may be best for people with PD to train in an environment where there are others around, who could offer help if needed.
- Beyond this, partners can help to motivate and engage each other in their exercise.
- People new to exercise programs are generally best off working with an individual or group training leader; for people whose mobility is significantly affected by PD, a physical therapist may be the best choice for helping to start a program.
Should exercise be done well before major motor symptoms of PD occur?

YES! Everyone should exercise more, whether they have PD or not.

- In PD, a special kind of neuron—brain cells—that produces the chemical transmitter dopamine gets damaged and lost.
- However, there is a lag between the time when the loss of neurons begins and the time when Parkinson’s motor symptoms start to show.
- In fact, by the time most people are diagnosed, as much as 40-60 percent of their dopamine neurons are already gone.
- The reason that people with Parkinson’s don’t experience symptoms until they reach this point is that the brain can compensate for the loss of dopamine neurons by gradually changing to adapt to the situation.
- In fact, the brain reshapes itself throughout life in response to experience. Scientists call this ability to change and compensate experience-dependent neuroplasticity.

Want to Learn More?

Print this checklist:  
Tai Chi and Yoga: Improving the Mind-Body Connection

Request a free copy of this NPF manual:  
Fitness Counts

Watch this video:  
How does exercise with music play a role in treatment?

Watch this video:  
What are the neuroprotective benefits of exercise for PD patients?

Watch this video:  
What types of exercise or exercise programs are recommended?

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