

Current Perspective on Exercise in Parkinson's Disease

Dhanya Vijayakumar*

Prisma Health Upstate, USA

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***Corresponding author:** Dhanya Vijayakumar, Prisma Health Upstate, 200 Patewood Dr, Suite B, Greenville, SC 29615, USA

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Mini Review

Parkinson's Disease (PD), the second most common adult-onset neurodegenerative syndrome, is characterized by four cardinal features: bradykinesia, rigidity, rest tremor, and postural instability. Exercise is an inexpensive, safe adjunct treatment that could be incorporated into the care of patients with PD. Different forms of exercises could be utilized, including aerobic exercise, strength training, flexibility training, and balance training. Stretching could help posture, stiffness, range of motion, and pain in PD, balance training could help postural stability, and aerobic exercises improve bone health, reduce cardiovascular disease incidence, and lower mortality [1]. Gait-specific training improves gait function more than a general exercise regimen [2]. Exercise is thought to modulate dopamine and glutamate neurotransmission, increase cerebral blood flow, and alter synaptogenesis, with different types of exercises having regional effects on brain circuitry [3]. Animal models have shown increased dopamine D2R protein expression and binding in the dorsolateral striatum after intensive exercise training for four weeks [4,5]. Exercise is also associated with increased hippocampal neurogenesis and improved memory [3].

There is level 1 evidence that exercise improves physical fitness and reduces motor symptoms in the OFF-medication state and health-related quality of life [1]. In an extensive PD patient database, regular exercise was associated with better quality of life, mobility, physical functioning, less caregiver burden, slower symptom progression, and less cognitive decline [6].

Large prospective studies also show that the risk of PD is significantly reduced by midlife exercise [7,8]. In addition to neuroprotective benefits, there is an increasing body of evidence that exercise may promote neural plasticity and slow disease progression in PD [9-11]. There is some thought that exercise may also help non-motor symptoms of fatigue, depression, and cognition, although more studies are needed to clarify this.

Given the postural instability, physical and cardiovascular deconditioning seen in later stages of PD, the type of exercise chosen must be tailored to meet patient needs, ensure safety, and avoid falls. Physical and occupational therapy referrals should be offered to all newly diagnosed PD patients to educate them about available resources and community programs. Although most movement disorders specialists stress the importance of exercise in PD, there is a general trend towards prescribing exercise and therapy once balance has already become an issue or after falls begin. However, earlier introduction of exercise and therapy may impact disease progression and overall well-being. High-intensity treadmill exercise may help delay the need for dopaminergic medications in patients with early PD [12]. Exercise may also be associated with increased life expectancy in PD patients [13] and has a multitude of benefits in unaffected individuals as well including partially reversing effect on aging, reduced risk of certain cancers, reduced risk of osteoporosis, and increased longevity [1].

PD has a pre-symptomatic stage that lasts between one to two decades before clinical symptoms begin. If these patients could be identified by clinical symptoms like REM behavioral disorder or using biomarkers, then exercise could potentially alter the disease course in this

pre-symptomatic population. Home-based exercises, community group exercise programs, PD classes, and individualized physical therapy are all forms of exercise treatments that could be utilized separately or in combination to help improve functioning.

Evidence supports treadmill walking, biking, running, Tai chi, yoga, dance, weight training, pilates, non-contact boxing, and several other exercise forms in PD [14]. Although there is ample data supporting the role of exercise in PD, there is still a lack of sufficient data on the amount, duration, intensity, or type of exercises that make a difference in motor symptoms of PD. The best available recommendation is the evidence-based guidelines published by the American College of Sports Medicine (ACSM) which recommends at least 30 minutes of aerobic activity three days a week, 30 minutes of strength training 2-3 days a week, along with balance, agility training 2-3 days/week and stretching more than 2-3 days a week with daily sessions being most effective. However, any exercise performed depending on patient preference, interest, safety, and availability is encouraged. The increasing availability and popularity of community exercise programs make this goal more achievable for patients. Intense physical therapy exercise programs like Lee-Silverman Voice Therapy-BIG (LSVT BIG®) are effective evidence-based programs that improve mobility and have various available programs for patients in different stages of PD [15]. Local PD exercise classes are also available in bigger cities across the nation.

There are several freely available exercise videos for PD patients including chair exercises for high fall risk and deconditioned patients by Mind & Mobility (South Florida), exercise video guides from the American Association of Retired Persons (AARP), American Parkinson Disease Association, Parkinson's Foundation, Brian Grant Foundation, European Parkinson's Disease Association, Parkinson's Exercise Program 4 You, Go4Life Exercise Videos by National Institute on Aging, Joy of Movement videos, U-Turn Parkinson's Workout Series, Power for Parkinson's exercise videos, Yoga for Parkinson's and Davis Phinney Foundation for Parkinson's. There are dance exercise class videos on YouTube by Dance Beyond Parkinson's and Dance for PD. There are free boxing workout videos by Neuroboxing, Parkies PunchBack, RockSteady Boxing On-Your-Own Exercise Series. There are exercise videos from Moving for Better Balance by New York YMCA, Live Large with Parkinson's at Countryside YMCA Ohio, Parkinson Wellness Recovery Moves of the Month, Moves with Claire among several other free resources [16].

In addition to these online resources, community-based fitness programs and PD-specific exercise groups make it easier for patients to stay motivated and access different exercise programs. With the increasing use of telehealth during the COVID-19 pandemic, patients can access exercise group programs from the comfort of their homes. The use of virtual reality technology for rehabilitation in PD has been studied and was noted to be comparable to conventional therapy in improving gait and balance [17-19]. The availability of different wearable sensors and the widespread use

of smartphones and smartwatches with inbuilt pedometer features make it easier to quantify exercise, daily steps and help improve mobility and exercise in PD patients. Every PD patient must be educated about the benefits of exercise and strongly encouraged to exercise to improve overall functioning and possible disease-modifying benefits.

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