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AMERICAN CONGRESS OF REHABILITATION MEDICINE

Archives of Physical Medicine and Rehabilitation

journal homepage: www.archives-pmr.org

Archives of Physical Medicine and Rehabilitation 2016;97:345-54

ORIGINAL RESEARCH

Comparative Effect of Power Training and High-Speed Yoga on Motor Function in Older Patients With Parkinson Disease

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Abstract

Objectives: To compare the effects of power training (PWT) and a high-speed yoga program on physical performances in older patients with Parkinson disease (PD), and to test the hypothesis that both training interventions would attenuate PD symptoms and improve physical performance.

Design: Randomized controlled trial.

Setting: A laboratory of neuromuscular research and active aging.

Participants: Patients with PD (N=41; mean age ± SD, 72.2±6.5y).

Interventions: Two high-speed exercise interventions (specifically designed yoga program and PWT) were given for 12 weeks (twice a week), and 1 nonexercise control group.

Main Outcome Measures: Unified Parkinson Disease Rating Scale motor score ($UPDRS_{MS}$), Berg Balance Scale (BBS), Mini-Balance Evaluation Systems Test (Mini-BESTest), Timed Up and Go, functional reach, single leg stance (SLS), postural sway test, 10-m usual and maximal walking speed tests, 1 repetition maximum (RM), and peak power (PPW) for leg press.

Results: For the posttests, both training groups showed significant improvements ($P<.05$) in all physical measurements except functional reach on the more affected side, SLS, and postural sway compared with the pretests, and significantly better scores for $UPDRS_{MS}$, BBS, Mini-BESTest, Timed Up and Go, functional reach on the less affected side, 10-m usual and maximal walking speed tests, 1RM, and PPW than controls, with no differences detected between the yoga program and PWT.

Conclusions: Both the specially designed yoga program and PWT programs can significantly improve physical performance in older persons with PD. Archives of Physical Medicine and Rehabilitation 2016;97:345-54

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Reduced motor function in Parkinson disease (PD), especially balance and mobility, typically results in loss of independence, increased fall incidence and related injuries, and reduced activity levels.[1,2] Bradykinesia, 1 of the cardinal symptoms of PD, has been attributed to rigidity, tremor, and muscle weakness.[3] Muscle power (force × velocity), especially leg power, has a greater effect on independence,[4,5] mobility,[3] and fall reduction[6,7] than strength in healthy older and PD populations, while decreased movement speed and muscle weakness significantly contribute to loss of muscle power in PD, especially when moving light to moderate loads.[3] These factors are especially important since most daily activities,[4] such as housekeeping, walking, and recovering from a stumble, require rapid movements under light to moderate external loading conditions.

Disclosures: none.

0003-9993/15/$36 - see front matter © 2016 by the American Congress of Rehabilitation Medicine
http://dx.doi.org/10.1016/j.apmr.2015.10.095

Movement speed is an essential consideration in any exercise intervention designed to address bradykinesia and physical function in PD.[3,8] Power-based resistance training (high speed, low resistance) has been shown to improve muscle strength and power, and physical functions, including gait speed, balance, and whole-body functional level, in older adults.[9] The only existing study[9] examining the efficacy of power training (PWT) shows that 12 weeks of PWT has a beneficial effect on leg muscle strength, power, and movement speed, but not on balance and gait speed. Therefore, whether PWT could attenuate PD symptoms and improve balance and mobility in PD needs further investigation.

Power Vinyasa yoga, characterized by fast transitions from 1 posture to another,[10] may be another effective exercise strategy to target bradykinesia, rigidity, and muscle function in PD. This is supported by our recent study[11] demonstrating that participation in a 3-month Power Vinyasa yoga intervention produced significant improvements in balance in healthy older fallers. Additionally, the benefits of classic yogic training in healthy populations include improvements in muscle strength,[12,13] power,[14] flexibility,[12,13] balance, and coordination.[11] Finally, yoga-based treatments have the potential to reduce fall risks[11,15] and improve quality of life[16] in individuals with musculoskeletal disorders. For patients with PD, 1 pilot study[17] indicated that a 12-week Iyengar yoga intervention improved motor function, balance, flexibility, and locomotion over a control group receiving no intervention.

To our knowledge, no previous study has compared the effects of high-speed resistance training and yoga in a controlled design. Therefore, the purpose of this study was to compare the effectiveness of high-speed yoga and PWT as interventions for addressing motor symptoms, balance, mobility, and muscle performance in older patients with mild to moderate PD. We hypothesized that both training interventions would attenuate PD symptoms and improve physical performance, but that the PWT program would produce a greater improvement.

Methods

Design

This study used a randomized controlled trial design. Participants were recruited from support groups and clinics in the area by advertising and physician referrals. After baseline assessments, the study coordinator allocated participants to PWT, the yoga group, or a control group using block randomization based on the Hoehn and Yahr Classification of Disability for PD (Hoehn and Yahr Scale), by using Excel software.[a] All testing was conducted at the Laboratory of Neuromuscular Research and Active Aging 1 hour after participants took their usual PD medications ("on" state), to minimize motor fluctuation and variability of motor symptoms among participants. The testing order was standardized among subjects and testing sessions. Pretests and posttests were performed within 2 weeks of the intervention.

List of abbreviations:

APD_{avg}	anterior-posterior average displacement
BBS	Berg Balance Scale
Mini-BESTest	Mini-Balance Evaluation Systems Test
MLD_{avg}	medial-lateral average displacement
PD	Parkinson disease
PPW	peak power
PWT	power training
RM	repetition maximum
SLS	single leg stance
$UPDRS_{MS}$	Unified Parkinson Disease Rating Scale motor score

Participants

Older patients (60−90y) with idiopathic PD, mildly to moderately impaired (Hoehn and Yahr Scale I−III), capable of ambulating for at least 50ft with or without an assistive device and rising from the floor with minimal assistance, with a score of ≥24 on the Folstein Mini-Mental State Examination, participated in this study. Exclusion criteria included the following: above stage III symptoms; progressive degenerative disease besides PD; spinal fusion or other orthopedic surgery in the previous 6 months; severe visual deficits; major depression or dementia; greater than minimal assistance required for gait and transfers; and regular practice (1−2 times/wk) of yoga or resistance training within the past year. All participants signed an informed written consent approved by the university's Human Subjects' Subcommittee. Participants were allowed to pursue their routine exercise during the study, but were instructed to discontinue participation in any resistance training or yoga program in which they had already enrolled.

Outcome measures

Unified Parkinson Disease Rating Scale motor score

The Unified Parkinson Disease Rating Scale motor score ($UPDRS_{MS}$) was the primary outcome measure used to evaluate the effectiveness of the 2 interventions in addressing motor dysfunction. The more and less affected sides were determined based on a sum of bradykinesia subscores (items 23−26).[18] Two testers evaluated subjects' performance separately, and interrater reliability (.904) was high for this test.

Balance

Two scales, the Berg Balance Scale (BBS)[19] and Mini-Balance Evaluation Systems Test (Mini-BESTest)[20]; 2 static balance tests, the single leg stance (SLS)[21] and postural sway tests[22]; and 2 dynamic balance tests, the Timed Up and Go[19] and functional reach,[19] were used. The SLS and functional reach were measured on both sides (less and more affected side). For the postural sway test, a portable force platform[b] recorded the sway area of the 95% confidence ellipse, the medial-lateral and anterior-posterior average displacement (MLD_{avg}, APD_{avg}) and SD (MLD_{SD}, APD_{SD}) with the patient during quiet standing with the feet a hip-width apart for 10 seconds with the eyes open and closed.[23] Three trials occurred under each condition, and the average value was recorded for each variable.

Leg press strength and peak power

Muscle strength (1 repetition maximum [RM]) and peak power (PPW) (the highest power achieved among 7 loading conditions: 30%, 40%, 50%, 60%, 70%, 80%, and 90% 1RM) were assessed using computerized pneumatic resistance machines[c] to evaluate neuromuscular capacity related to fall risk.[24] The 1RM protocol was used previously with older individuals.[25] After a warm-up,

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