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RESEARCH SUMMARY & SAMPLE WORKOUT

Effect of Aquatic Exercise on Gait and Balance for Individuals with Parkinson's Disease

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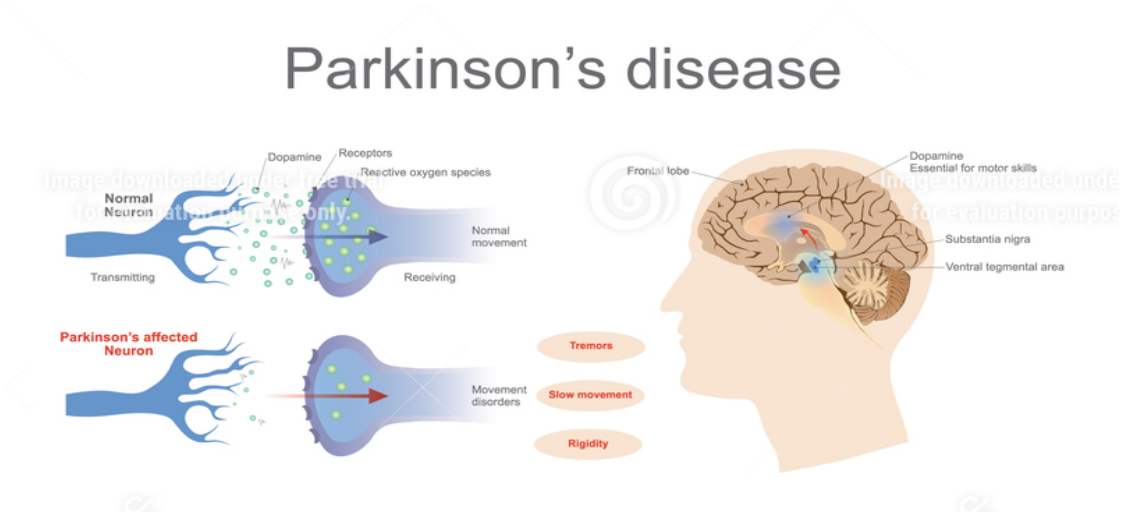
INTRODUCTION

Parkinson's disease (PD) is defined as a chronic neurodegenerative disease specified by the loss of dopaminergic neurons of the basal ganglia of the brain.



Changes in balance with PD are due to the lack of motor function along with poor proprioceptive cues and visual processing. Gait in PD, characterized by a forward shift of gravity, shuffling pattern, and inhibited compensation with upper body balance, is associated with an increased risk of falls.

While it cannot reverse PD, exercise can slow its progression and improve symptoms. Exercise can decrease rigidity, improve postural stability, improve gait, increase balance, prevent falls, and improve quality of life in those with PD.

Benefits of Aquatic Exercise

- 89-93 F (32-34 C) degree water promotes muscle relaxation.
- Buoyancy offloads and supports the body to allow this population to safely exercise.
- Hydrostatic pressure compresses the body and increases oxygen delivery to the muscles, which allows the body to move more efficiently.
- Turbulence provides postural challenge.
- Viscosity slows movement to allow for postural corrections without the risk of falls.

EXERCISE RECOMMENDATIONS

Aquatic exercise should be performed 3 times a week for 45 minutes to 1 hour. A 10-minute warm-up should be used to allow for proper acclimation to the water and allow acute symptoms to subside.

Gait and Balance

Fall prevention is an important aspect of training for those with PD. Water viscosity and turbulence, as well as the addition of equipment, successfully challenge balance and gait without negative consequence.

20-30 minutes of gait and balance-specific exercises in the water has shown:

- 30% increase in mobility on land
- 20% decrease of fall risk on land

Postural Stability and Functional Training

Postural stabilization and functional training, such as trunk strengthening and task-oriented ADL water exercises, contribute to increasing gait and balance on land by providing a stronger core and base of support.

10-15 minutes of postural stability and functional mobility exercise in water reveals:

- 18% increase in functional reach while standing on land, leading to increased overall balance
- 33% increase in the ability to safely go from sitting to standing on land
- Significant decrease of symptoms (assessed with PD specific scale)

CONCLUSION

Aquatic exercise can help decrease symptoms of PD and the overall progression of the disease. Aquatic PD programs and therapeutic techniques can improve balance and gait, and decrease fall risk on land. Functional mobility and postural stability water exercise options enhance activities of daily living and dual task function while improving quality of life.

Exercise Type	Example	Progression and Equipment
Gait Specific	Walking forward and backwards Walking side to side (changing directions)	Moving head or arms to increase vestibular challenge Submerging a kickboard or noodle to increase surface area
Balance Specific	Standing with eyes closed Standing in tandem, wide or narrow base Standing on one foot	Standing on foam noodle to increase proprioception Performing a moving exercise and then challenging balance with increased turbulence
Postural Stability	Trunk exercises including rotating upper and lower body in opposition Crunches performed suspended on a stabilized noodle (someone holds noodle)	Performing exercises on a noodle without stabilization Adding handheld resistance equipment
Functional Training	Standing and reaching to grab a float Throwing and catching a ball	Multidirectional movements - in front, to the side, and behind Switching hands or altering base of support

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SAMPLE WORKOUT

Parkinson's Disease (PD) is defined as a chronic neurodegenerative disease specified by the loss of dopaminergic neurons of the basal ganglia of the brain.

Changes in balance with PD are due to the lack of motor function along with poor proprioceptive cues and visual processing. Gait in PD is characterized by:

- forward shift of gravity
- shuffling pattern
- inhibited compensation with upper body balance
- risk for falls

Exercise can slow the progression of this disease while improving current symptoms but cannot reverse the disease. Exercise for this population aims to:

- decrease rigidity
- improve postural stability
- improve gait
- increase balance
- prevent falls
- improve quality of life

Benefits of aquatic exercise include:

- 89-93-degree water promotes muscle relaxation.
- Buoyancy offloads and supports the body to allow this population to safely exercise.
- Hydrostatic pressure compresses the body and leads to increased oxygen delivery to the muscles that allows the body to move more efficiently.
- Turbulence provides a balance challenge.
- Viscosity slows movement to allow for postural corrections without the risk of falls.

Warm-Up
10 minutes
The warm-up allows a person with PD to properly acclimate to the aquatic environment as well as prepare the body for exercise. Depth of water can be used to give the body more support (chest or shoulder depth) or less support for more challenge (waist depth).

- Form-focused Forward Walking. Focus on body awareness and proprioceptive cues received from their feet. Shoulders over hips, walking heel to toe, and equal stride length are important and should be cued. Noodles can be used for balance. **2 minutes**
- Form-focused Backward Walking. Focus on body awareness and proprioceptive cues. Shoulders over hips, walking toe to heel, and equal stride length are important and should be cued. Noodle can be used for added balance. **2 minutes**
- 4 Side Steps Left + 4 Side Steps Right. Step length should be equal on both sides and shoulders over hips. Hold a noodle in both hands in front for balance. **2 minutes**
- Standing. Feet shoulder width apart; shoulders over hips over toes. Try to remain balanced, a noodle can be added for stability. Challenge: close eyes for 30 seconds, look up and down for 30 seconds. **2 minutes**
- Kickboard Walking Forward & Backward. This exercise will increase challenge by adding more surface area and resistance in the water. The kickboard can be partly or fully submerged. **2 minutes**

Gait and Balance Training
25 minutes
This component of the workout is important for improving mobility and reducing fall risk. The water is a safe place to practice these activities and therefore allows participants to challenge themselves more than they are capable to on land. The newly learned skills from the water reflect on land balance and gait abilities.

- Walking, Swinging Arms. Simulating land-based walking with proper technique. **1 minute**
- Walking, Turning Head. Eliminating visual spot. **1 minute**
- Walking, Eyes Closed. Eliminating visual processing all together. **1 minute**
- Walking, Short Stride Forward & Long Stride Backward (switch halfway through). Challenging gait due to unequal stride length, changing direction, and turbulence. **3 minutes**
- Walking, In Tandem Forward & Normal Stride Backward (switch halfway through). Challenging gait due to decreasing base of support, changing direction, and turbulence. **4 minutes**
- Walk in Circle 1 minute, Stop & Stand In Tandem 30 seconds. Repeat 4 times. Challenging gait due to creating turbulence and constant directional changes. Challenging balance due to self-turbulence, suddenly stopping, and decreased base of support. **6 minutes**
- Standing with Waves. Divide class into two groups. One group walks in random patterns around stationary participants while also creating waves by sculling their hands. 90 seconds and switch; perform each role twice. Creating turbulence to challenge balance (standing participants) while simultaneously challenging gait (moving participants). **6 minutes**
- Standing, Eyes Close. Challenging balance by eliminating visual field. Change base of support throughout. Add noodle under feet for decreased proprioceptive cues: narrow, wide, and in tandem for 1 minute each. **3 minutes**

Postural Stability and Functional Training
15 minutes
Postural stabilization and functional training, such as trunk strengthening and task-oriented ADL water exercises. This contributes to increasing gait and balance on land by providing a stronger core and base of support.

- Noodle Crunches. Supine with noodle positioned around back and under armpits. Perform crunches bringing both knees to chest; focus on spinal flexion and extension. Trunk strengthening for postural stabilization. Perform for 1 minute with 30 seconds of rest; repeat 2 times. **3 minutes**
- Noodle Russian Twists. Similar to above, add a twist moving the lower and upper body in opposition. Trunk strengthening for postural stabilization. Perform for 1 minute with 30 seconds of rest; repeat 2 times. **3 minutes**
- Noodle Side Bends. Supine with noodle positioned around back and under armpits. Bend side to side reaching for the knees. Trunk strengthening for postural stabilization. Perform for 1 minute with 30 seconds of rest; repeat 2 times. **3 minutes**
- Reach to pick up floating objects. With a partner, have one participant stand stationary while the other pushes floating objects in multiple directions around them. The person standing stationary will reach forward, side to side and back behind them to grab the objects. Halfway through, switch roles. A functional exercise to challenging balance and assisting with ADLs on land. **3 minutes**
- Toss with Partner. With a partner, pass a ball back and forth; include travel to increase challenge. Use both hands, left hand only, and right hand only to catch the ball. Challenging dynamic balance and hand-eye coordination and assisting with ADLs on land. **3 minutes**

Cool-Down
10 minutes
Important to avoid muscle soreness in the hours and days after exercise. ROM exercise and stretching should be performed to decrease muscle tightness.

- Easy Walking (front, back, side to side). Cue for proper form. **4 minutes**
- Bicycle (forward and backward). Perform with arms resting on noodle. **3 minutes**
- Leg Swings (front to back, side to side). Noodle in both hands for balance. **1 minute**
- Knee to Chest. Stretch leaning back on noodle, bringing one knee to chest; repeat on both sides. **2 minute**s