

Indexing Metadata/Description

- › **Title/condition:** Parkinson's Disease: A Focus on Balance and Gait
- › **Synonyms:** Parkinson disease: a focus on balance and gait
- › **Anatomical location/body part affected:** Specific neurons in the basal ganglia of the brain (dopaminergic neurons of substantia nigra pars compacta)
- › **Area(s) of specialty:** Acute Care, Home Health, Neurological Rehabilitation, Geriatric Rehabilitation
- › **Description**
 - Parkinson's disease (PD) is a chronic, progressive neurodegenerative disorder characterized by the cardinal features of rigidity, bradykinesia, tremor, and postural instability⁽¹⁾
 - "Parkinsonism" – refers to a group of disorders that produce abnormalities of basal ganglia function⁽¹⁾
 - PD is the most common form of parkinsonism
- › **ICD-10 codes**
 - G20 Parkinson's disease

(ICD codes are provided for the reader's reference, not for billing purposes)

- › **Reimbursement:** No specific issues or information regarding reimbursement has been identified
- › **Presentation/signs and symptoms**
 - PD is a slow, progressive disease⁽¹⁾ with a typical disease course lasting 10–15 years⁽³⁾
 - Prevalence:
 - PD affects more than 1 million persons in North America⁽⁶⁾
 - 5/100,000 individuals < 40 years of age
 - 700/100,000 individuals > 70 years of age
 - In the United States, highest incidence of PD is in Whites; lowest incidence is in Asian Americans and Blacks
 - Symptoms generally begin between the ages of 50 and 60 years⁽¹⁾
 - The four cardinal signs used to diagnose PD are the following:⁽⁶⁾
 - Muscular rigidity
 - Increased muscle tone that persists throughout full passive ROM of the involved joint and is not velocity dependent
 - Typically presents asymmetrically
 - Bradykinesia and akinesia
 - Bradykinesia: slowness of movement
 - Akinesia: loss or absence of voluntary movement
 - Tremor⁽⁶⁾
 - Typically occurs at rest with a frequency of 4 to 7 Hz
 - First noted in the hand as a pill-rolling tremor (thumb and forefinger movement)
 - Can also occur in the leg and lip
 - Tremor improves with purposeful movement
 - Usually occurs asymmetrically at first

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- Postural instability
 - Loss of postural reflexes; classic test is known as the “pull test” in which the patient falls or has a delayed response to being “pushed backwards” when standing
 - Signs of postural instability occur later in the disease progression, after the other 3 cardinal signs and symptoms are present; generally, 8 or more years after onset⁽⁴⁾
 - If postural stability is greatly impaired early on, then other neurological diseases should be ruled out⁽⁶⁾
- Other signs and symptoms that may be present
 - Mobility and gait impairment⁽⁶⁾
 - Difficulty initiating stepping
 - Small shuffling steps that increase in speed and decrease in length, known as a festinating gait pattern
 - Freezing of gait
 - Anterior trunk lean
 - Sensory system impairment (e.g., altered perception to touch and pain stimuli, increased pain sensitivity)⁽¹⁾
 - Speech impairments (e.g., reduced volume of speech known as hypophonia, and voice often “gruffer”)⁽⁶⁾
 - For more information on speech impairments in individuals with PD, see *Clinical Review ... Parkinson Disease (Speech)* ; CINAHL Topic ID Number: T708751
 - Swallowing impairments⁽¹⁾
 - Drooling⁽⁶⁾
 - For more information on swallowing impairments in patients with PD, see *Clinical Review ... Dysphagia: Parkinson Disease* ; CINAHL Topic ID Number: T708934
 - Alterations in behavior⁽¹⁾
 - (e.g., impulse control disorders)
 - Cognitive decline⁽¹⁾
 - (e.g., memory difficulties, slowed thinking)
 - Impairment of the autonomic nervous system⁽¹⁾
 - (e.g., orthostatic hypotension, thermoregulatory dysfunction)
 - Impairment of the gastrointestinal system⁽¹⁾
 - (e.g., constipation, weight loss)
 - Impaired ADLs⁽¹⁾
 - Depression⁽¹⁾
 - Masked facies, also known as hypomimia, in which an individual’s face seems expressionless, giving the appearance of depression or lack of emotion⁽⁶⁾
 - Decreased ability to blink⁽⁶⁾
 - Micrographia (handwriting becomes smaller in size)⁽⁶⁾
- Signs and symptoms in relation to disease progression/phase of disease
 - Early- to mid-stage PD
 - Symptoms present in one extremity initially; as disease progresses, symptoms develop bilaterally^(1,5)
 - Poor legibility with handwriting⁽³⁾
 - Cogwheel rigidity⁽²⁾
 - Resting tremor,⁽⁵⁾ generally the first symptom observed⁽⁴⁾
 - Reduced/absent arm swing during gait
 - Late- or advanced-stage PD
 - Balance and posture become significantly impaired⁽¹⁾
 - Festinating gait; falls are common⁽⁶⁾
 - Loss of postural reflexes/postural instability(e.g., difficulty maintaining balance when changing direction)⁽³⁾
 - Flexed trunk posture⁽²⁾
 - Periods of freezing⁽³⁾

- Initiating and ending movement becomes extremely challenging for the patient⁽³⁾
 - For example, attempting to transition from sit to stand is problematic⁽³⁾
- Dysphagia⁽³⁾
- Dementia occurs in about one-third of individuals with PD
- Akathisia – a sense of inner restlessness and need to move⁽¹⁾
- End-stage PD
 - Assistance is required for all ADLs⁽³⁾
 - The patient may develop flexion contractures of the neck and trunk, making full extension when in supine impossible⁽⁵⁾
 - During ambulation the patient will require physical assist as well as the use of an assistive device⁽³⁾
- The classification system of PD created by Hoehn and Yahr (1967)⁽⁷⁾ is used to stage the severity of symptoms of PD. The Hoehn and Yahr stage is included as one part of the 6-part Unified Parkinson's Disease Rating Scale (UPDRS)
 - Stage I
 - Unilateral involvement only, usually with minimal or no functional impairment
 - Stage II
 - Bilateral or midline involvement, without impairment of balance
 - Stage III
 - First sign of impaired righting reactions. This is evident by unsteadiness as the patient turns and when the patient is pushed from standing equilibrium with the feet together and eyes closed
 - Functionally the patient is somewhat restricted in activities but may have some work potential depending upon the type of employment
 - Patient is physically capable of leading an independent life, disability is mild to moderate
 - Stage IV
 - Fully developed, severely disabling disease; the patient is still able to walk and stand unassisted but is markedly incapacitated
 - Stage V
 - Confinement to bed or wheelchair unless aided

Causes, Pathogenesis, & Risk Factors

› Causes of PD

- Idiopathic⁽⁶⁾
- Genetic⁽⁶⁾
 - There are rare familial forms with at least 7 different genes identified, including the *PARK2* gene, which is a significant cause of early-onset autosomal recessive PD
- Probably multifactorial; hypotheses include a combination of environmental (e.g., exposure to pesticides) and genetic factors that contribute to the development of PD^(5,6)
- Viral⁽⁵⁾

› Pathogenesis

- Theories of the pathogenesis of PD⁽²⁾
 - Misfolding and aggregation of proteins—the buildup of proteins ultimately causes cells to break down
 - Mitochondrial dysfunction leading to oxidative stress—the accumulation of toxic substances eventually leads to cell breakdown
- The basal ganglia are affected by PD and as a result motor planning and motor control are impaired
- Specifically, neuronal degeneration and death occur in the substantia nigra of the basal ganglia⁽⁸⁾
- Dopamine levels in the brain are reduced secondary to the degeneration of the substantia nigra neurons which produce the neurotransmitter⁽¹⁾
- Lewy bodies (clusters of protein [called alpha-synuclein] that develop in the mid-brain, brainstem, and olfactory bulb)⁽⁸⁾ may arise as the disease advances^(1,5)
- Postural instability in PD may involve dysfunctions in several subsystems. Impaired integration of sensory feedback from the visual, proprioceptive, and vestibular systems can contribute to deficits in gait and balance⁽³¹⁾

› Risk factors

- Incidence increases with advancing age⁽⁵⁾
 - Estimates are that 1 in 3 adults over the age of 85 will have PD⁽⁵⁾
- Family history may be an important risk factor⁽⁵⁾
 - Twin studies indicate that there is not likely a single gene involved in PD
 - Studies have identified 2 genetic loci associated with PD⁽⁵⁾
- Low muscle strength has been found in late adolescence in individuals in whom PD was diagnosed 30 years later⁽¹⁷⁾
 - Researchers in Sweden investigating whether this lower muscle strength translates into increased risks found that there is an increased risk of falling and hip fracture prior to diagnosis of PD⁽¹⁷⁾
 - This may suggest that clinically relevant neurodegenerative impairment is already present many years before the diagnosis is made

Overall Contraindications/Precautions

- › The individual's endurance may be decreased, especially in the later stages of the disease. Evaluation and treatment procedures should be modified according to the patient's tolerance⁽¹⁾
- › The clinician should check with nursing or speech therapy prior to giving the patient anything to eat or drink, as the patient may be at risk for aspiration. Please see *Clinical Review... Dysphagia: Parkinson's Disease*, referenced above
- › **Patients with this diagnosis are at risk for falls; follow facility protocols for fall prevention and post fall-prevention instructions at bedside, if inpatient. Inform patient and family/caregivers of the potential for falls and educate about fall-prevention strategies. Discharge criteria should include independence with fall-prevention strategies**
 - Falling and sequelae of falling are common problems in PD
 - More than two-thirds of all patients with parkinsonism fall⁽⁵⁾
 - More than 10% of patients with parkinsonism fall more than once a week⁽⁵⁾
- › See specific **Contraindications/precautions to examination** and **Contraindications/precautions** under **Assessment/Plan of Care**

Examination

› Contraindications/precautions to examination

- Clinicians need to respect the patient's perceived level of pain
- Clinicians need to be aware that individuals with PD often have a fear of falling and that this can negatively impact gait and balance
- The clinician should consider the "on-off" phenomenon related to a patient's medication schedule when completing an evaluation as well as during treatment.⁽¹⁾ The clinician should document when the patient took his or her medication. It may be useful to observe the patient during both the "on" and "off" states
 - "On-off" phenomenon⁽¹⁾
 - Observed in about one-half of patients with PD on medications for PD symptoms for > 2 years
 - "On" – The patient is at his or her highest level of function
 - "Off" – As the medication wears off, dyskinesias (involuntary movements) typically appear and, overall, symptoms increase in severity

› History

- **History of present illness/injury:** Depending on unique patient circumstances and the stage of PD, caregiver report may need to be obtained in order to complete a thorough and accurate history
 - **Mechanism of injury or etiology of illness**
 - When did the patient's symptoms begin?
 - When was PD diagnosed?
 - What were the symptoms at onset and what has been the rate of progression?
 - What complications has the patient experienced?
 - Has the patient experienced a fall? Rate of occurrence?

–Course of treatment

- Medical management

- May include patient education, medication, rehabilitation, and deep brain stimulation
- Surgical treatment with deep brain stimulation is indicated for patients with significant motor fluctuations, dyskinesias, or tremor not responding to medication⁽⁶⁾

- Medications for current illness/injury: Determine what medications clinician has prescribed; are they being taken?

Does the patient report any side effects from the medications?

- Levodopa/carbidopa (Sinemet) remains the gold standard medication to treat PD⁽²⁾
 - A significant side effect of the prolonged use of levodopa is the presentation of dyskinesias⁽²⁾
- Other medications
 - Monoamine oxidase B (MAO-B) inhibitors and dopamine agonists⁽²⁾
 - May be used in younger patients to delay the use of levodopa
 - MAO-B inhibitors can prolong the duration of action of levodopa
 - Catechol-O-methyltransferase (COMT) inhibitors⁽²⁾
 - Can prolong the duration of action of levodopa
 - Apomorphine SC injection (Apokyn)⁽²⁾
 - May be used as a rescue medication for “off states”⁽²⁾
 - Amantadine (Symmetrel)⁽²⁾
 - May be used as an anti-dyskinetic agent
 - Anticholinergics
 - May be used for tremor refractory to other treatments
- The patient may also be prescribed medications for the treatment of depression, psychosis, and dementia⁽⁶⁾

- Diagnostic tests completed

- PD is largely a clinical diagnosis and often is made based on a comprehensive history and physical examination. Physicians can still diagnose PD and begin treating the patient for it even if the patient does not demonstrate all four cardinal signs (TRAP: tremor, rigidity, akinesia/bradykinesia, postural instability)⁽⁶⁾
- MRI may be used to assist in differential diagnosis⁽⁶⁾

- Home remedies/alternative therapies: Document any use of home remedies (e.g., ice or heating pack) or alternative therapies (e.g., acupuncture) and whether they help

- Researchers in Japan examined immediate effects of acupuncture on gait in 27 outpatients with PD and found significant increases in gait speed, step length, ground reaction force, and cadence⁽¹⁸⁾

- Previous therapy: Document whether patient has had occupational or physical therapy for this or other conditions and what specific treatments were helpful or not helpful

–Aggravating/easing factors (and length of time each item is performed before the symptoms come on or are eased):

- Resting tremor—generally aggravated by anxiety⁽³⁾
- Document the presence of the “on-off” phenomenon and the impact on the patient’s symptoms⁽¹⁾

–Body chart: Use body chart to document location and nature of symptoms

–Nature of symptoms: Document nature of symptoms (e.g., constant vs intermittent)

–Rating of symptoms: Use a visual analog scale (VAS) or 0–10 scale to assess symptoms at their best, at their worst, and at the moment (specifically address if pain is present now and how much)

–Pattern of symptoms: Document changes in symptoms throughout the day and night, if any (A.M., mid-day, P.M., night); also document changes in symptoms related to medication schedule,⁽¹⁾ weather, or other external variables

- Does freezing of gait occur in the “off” state, but disappear in the “on” state?
- Does freezing of gait occur in the “on” state, but disappear in the “off” state?
 - If yes, does it improve or get aggravated with stronger dopaminergic medications?

–Sleep disturbance

- Sleep disorders are common in PD⁽⁵⁾ and can include:
 - insomnia
 - excessive daytime sleepiness

- sudden involuntary episodes of sleep
- REM sleep disorder
- restless legs syndrome
- sleep apnea
- nocturia
- Document number of wakings/night

–**Other symptoms**

- Document other symptoms patient may be experiencing that could exacerbate the condition and/or symptoms that could be indicative of a need to refer to physician (e.g., dizziness, bowel/bladder/sexual dysfunction)

–**Respiratory status:** Document any known respiratory compromise (e.g., need for supplemental oxygen, history of pneumonia)

–**Barriers to learning**

- **Are there any barriers to learning? Yes ___ No ___**

- **If Yes, describe _____**

- Learning deficits have been found in patients with PD⁽⁵⁾

- Procedural learning (learning that occurs with practice, such as when gradually acquiring a motor skill) is particularly affected⁽⁵⁾

- Studies suggest that patients with PD can acquire procedural learning but need more practice than control subjects

• **Medical history**

–**Past medical history**

- **Comorbid diagnoses:** Ask patient about other problems, including diabetes, cancer, heart disease, psychiatric disorders, orthopedic and disorders

- **Medications previously prescribed:** Obtain a comprehensive list of medications prescribed and/or being taken (including OTC drugs)

- **Other symptoms:** Ask patient about other symptoms he/she may be experiencing

- **Past surgical history:** Inquire about any past surgeries (note date as well as reason for surgery)

• **Social/occupational history**

–**Patient's goals:** Document what the patient and caregiver hope to accomplish with therapy and in general

–**Vocation/avocation and associated repetitive behaviors, if any:** How much daily physical activity does the patient perform? Persons with PD are less physically active than persons of a similar age without PD.⁽³²⁾ Falls and fear of falling are associated with less physical activity in patients with PD, even after adjusting for physical impairments.⁽¹¹⁾ Does the patient work? What is the nature of the work tasks?

–**Functional limitations/assistance with ADLs/adaptive equipment:** Document any reported limitations in ADLs. What assistive or adaptive devices does the patient currently use? Which extremity is dominant?⁽¹⁾ It may be helpful to inquire about the impact of PD on certain ADLs; for example, during tooth brushing the patient may experience increased rigidity secondary to the repetitive nature of the task

–**Living environment:** Stairs, number of floors in home, with whom patient lives, caregivers, etc. Identify if there are barriers to independence in the home; any modifications necessary? Has a home safety evaluation been performed?

› **Relevant tests and measures: (While tests and measures are listed in alphabetical order, sequencing should be appropriate to patient medical condition, functional status, and setting.)** Assessment procedures may vary depending on the reason for referral and the stage of PD in which the patient is presenting. The clinician should modify accordingly. In some of the areas listed below, common findings are listed; however, these too may vary depending on the individual's unique circumstances. The evaluation procedures listed below are an overview; the clinician should supplement the evaluation process with additional measures as indicated

• **Anthropometric characteristics:** Document height and weight and calculate BMI. Assess and measure edema as indicated⁽¹⁾

• **Arousal, attention, cognition (including memory, problem solving)**

–Perceptual deficits increase with progression of the disease⁽⁵⁾

–The Mini-Mental State Examination (MMSE) may be used to screen for cognitive impairment⁽¹⁾

–Obtain testing completed by other disciplines (e.g., speech or cognitive psychology)

–Persons with PD who show freezing of gait tend to have dysfunction in cognitive domains⁽¹⁹⁾

- Freezing of gait is associated with executive dysfunction involving response inhibition, divided attention or switching attention, and visuospatial function
- **Assistive and adaptive devices:** Does the patient currently utilize assistive and adaptive devices? Are they appropriate and being used safely?
- **Balance**
 - Complete a thorough assessment of balance
 - Assess static and dynamic reactions (e.g., during sitting, standing, and ambulation)
 - Assess balance strategies used
 - Postural instability and falls are common in individuals with PD⁽⁷⁾
 - Balance outcome measures that may be used include the functional reach test, Berg Balance Scale (BBS), Balance Evaluation Systems Test (BESTest), Mini-BESTest, and the ABC Scale
 - Researchers in the United States found that the BESTest and the Mini-BESTest, which specifically assess reactive postural response and stability in gait, were more likely than the Berg Balance Scale to detect differences in balance between individuals with PD who have freezing of gait and those who do not have freezing of gait⁽²⁰⁾
 - It appears that there are specific aspects of balance that are worse in persons with PD with freezing of gait than in persons with PD without freezing of gait
 - The BESTest is a comprehensive and systematic approach to assessment of balance. However, it can take longer than 30 minutes to administer and so is not as feasible as other clinical balance tests for clinical use
 - Investigators sought to determine if the BESTest, as well as more time-efficient tests such as the Mini-BESTest and the Berg Balance Scale, could distinguish between PD with freezing of gait and PD without freezing of gait
 - Participants included 78 individuals with idiopathic PD, 32 of whom had freezing of gait
 - After accounting for motor severity, years since diagnosis, and age, patients with PD and freezing of gait had lower BESTest total scores and Mini-BESTest scores compared to patients without freezing of gait
 - There was no between-group difference in Berg Balance Scale scores
 - Analyses of specific components of the BESTest show that patients with PD and freezing of gait have worse reactive postural responses and stability in gait than patients without freezing of gait
 - The Mini-BESTest also differentiated between the groups, whereas the Berg Balance Scale did not, and may be preferred to the BESTest in clinical practice because it requires less time to administer
 - Various self-report and performance-based tests have been investigated for their ability to predict recurrent falls in persons with PD^(21,22,23)
 - Researchers in Australia found that the 16-item ABC scale (ABC-16) and the short form 6-item ABC scale (ABC-6) independently identify patients with PD at risk of future falls, in a 12-month prospective cohort study that involved 79 persons with idiopathic PD in the community⁽²¹⁾
 - The Fullerton Advanced Balance Scale, Mini-BESTest, and Berg Balance Scale were all found to have moderate capacity to predict “fallers” and “nonfallers” in a prospective study in Germany that involved 85 patients with PD⁽²²⁾
 - Only some items of the 3 scales contribute to detection of future falls. Specific items identified were “tandem stance,” “one-leg stance,” “rise-to-toes,” “compensatory stepping backward,” “turning 360 degrees,” and “placing foot on stool”
 - Researchers in Brazil found that the ABC and the Falls Efficacy Scale–International (FES-I) demonstrated moderate accuracy in predicting recurrent falls and that their predictive ability was similar to that of performance-based measures, in particular the functional reach test and the TUG test⁽²³⁾
 - A combination of 2 measures may improve the ability to predict recurrent falls. The combination of the Berg Balance Scale and the FES-I was specifically recommended
 - The “pull test” may also be used to assess balance⁽⁶⁾
 - The patient is pulled backwards at the shoulders
 - Abnormal response is when the patient cannot recover from balance perturbation without assistance; this is observed in later stages of PD
- **Cardiorespiratory function and endurance**
 - Assess and monitor vital signs
 - The individual’s exertion can be assessed using Borg Rating of Perceived Exertion (RPE) Scale⁽¹⁾
 - Endurance can be assessed using the 6-minute walk for distance test (6MWT)
- **Ergonomics/body mechanics:** Observe the patient’s body mechanics during functional tasks

- **Functional mobility (including transfers, etc.):** Complete a functional assessment; examples of tests that can be used include the FIM, Five Times Sit to Stand test (FTSTST), and TUG test
- **Gait/locomotion**
 - Complete a thorough assessment of gait; outcome measures such as the 10-meter walk test (10MWT) for gait speed⁽¹⁾ and the DGI for gait safety should be used
 - Stride length and gait speed will likely be reduced; gait appears flat-footed⁽⁵⁾ and shuffling in nature
 - Festinating gait—gait characterized by increasing speed with shortening of stride⁽¹⁾
 - Researchers in Turkey identified the following factors as being related to slower gait: older age, clinically advanced disease, poor mobility, fear of falling, falling history, higher falling risk, and mood disorder. There was no correlation between gait speed and comorbidity⁽²⁴⁾
 - Assess ability to turn. Difficulty changing direction while walking is a common complaint in PD⁽²⁵⁾
 - Turning is slower and more steps are required to complete a turn
 - Using motion analysis, researchers in the United States found that subjects with PD did not widen the distance between their feet for turning compared to control subjects, and tended to cut short their turns, resulting in a shorter walking path
 - Patients with PD had lower dynamic stability than control subjects, especially when asked to perform 90° turns and when asked to walk and turn faster than their preferred speed
 - The ability to dual task is important for safe gait and completion of ADLs⁽¹²⁾
 - When asked to dual task during ambulation, patients with PD typically show a reduction in stride length, have more freezing episodes, and display a greater stride-to-stride variability⁽¹²⁾
 - These all contribute to increased fall risk
 - Functional Gait Assessment (FGA)⁽¹⁰⁾
 - Comprises 10 items: gait on level surface, change in gait speed, gait with horizontal head turns, gait with vertical head turns, gait and pivot turn, step over obstacle, gait with narrow base of support, gait with eyes closed, retro-ambulation, steps
 - Each item is scored on a 4-point ordinal scale (0–3), with the higher the composite score the better balance and gait ability
 - In a 2014 study in China researchers assessed the construct, concurrent, and predictive validity of the FGA based on 121 patients with PD. Results indicated the following:
 - Good construct validity and moderate to strong significant correlations between the FGA and the BBS, TUG test, ABC Scale, and UPDRS; the cutoff point for predicting falls within 6 months was a score of 18 with a sensitivity of 80.6% and specificity of 80%
- **Joint integrity and mobility:** Assess joint integrity as indicated and appropriate
- **Motor function (motor control/tone/learning)**
 - Complete a thorough assessment of muscle tone; “cogwheel” or “lead pipe” rigidity generally is present⁽⁵⁾
 - Assess rapid, alternating movements and document if bradykinesia is present⁽³⁾ (e.g., turning hands palm up and palm down)
 - Observe for a resting tremor that lessens or is absent with volitional activity; postural tremor may also be noted⁽⁵⁾
 - Resting tremor—may be referred to as Parkinsonian tremor or “pill-rolling” tremor
 - The frequency generally is 4–7 Hz
 - Observed in distal extremities and is rhythmic
 - May consist of supination/pronation, finger flexion/extension, or be the “pill-rolling” form
 - Document the presence of freezing episodes⁽¹⁾
 - The clinician can time certain functional tasks as a means to quantify the impact of bradykinesia⁽¹⁾
- **Muscle strength:** Complete a muscle strength assessment. MMT can be used if no abnormal tone or coordination issues are present
- **Observation/inspection/palpation** (including skin assessment): Document the presence of any skin breakdown and ensure the medical team is aware of any skin compromise
- **Perception** (e.g., visual field, spatial relations): The patient’s vision should be assessed (e.g., depth perception, peripheral vision).⁽¹⁾ Persons with PD might experience eye and vision problems including blurred vision due to slowed (hypometric)

saccadic movements and dry eyes due to decreased blinking. Dysfunction in dopaminergic receptors in the retina can cause loss of contrast sensitivity

- **Posture**

- Complete a postural assessment; a flexed posture is typical⁽⁵⁾

- Individuals may compensate for this shift and carry themselves in atypical postures.⁽¹⁾ (Clinicians should be aware that anteropulsion [center of mass [COM] shifted anteriorly] is observed more often than retropulsion in patients with PD)⁽¹⁾

- **Range of motion**

- Complete a thorough ROM assessment

- In the lower extremities, reduced extension is common in the hips and knees; reduced dorsiflexion is also common⁽¹⁾

- In the upper extremities, reduced extension in the elbow and reduced shoulder flexion are typical⁽¹⁾

- In the spine, extension and rotation may be reduced⁽¹⁾

- **Reflex testing:** Deep tendon reflexes should be normal⁽³⁾

- **Self-care/activities of daily living (objective testing):** Barthel Index can be used as indicated. The UPDRS has a section assessing ADLs. The Parkinson's Disease ADL scale (PADLS) is a self-report ADL scale designed to assess difficulties in daily activities due to PD

- **Sensory testing**

- Assess proprioception and kinesthesia, as both may be impaired⁽¹⁾

- **Special tests specific to diagnosis**

- The UPDRS is the most commonly used scale in the clinical study of PD⁽³⁰⁾

- It is used to follow the longitudinal course of the disease

- Consists of 6 parts:

- Part I: evaluation of mentation, behavior, and mood

- Part II: self-evaluation of ADLs including speech, swallowing, handwriting, dressing, hygiene, falling, salivating, turning in bed, walking, and cutting food

- Part III: clinician-scored monitored motor evaluation

- Part IV: complications of therapy

- Part V: Hoehn and Yahr staging of severity of PD

- Part VI: Schwab and England ADL scale

Assessment/Plan of Care

› **Contraindications/precautions**

- **Only those contraindications/precautions applicable to this diagnosis are mentioned below, including with regards to modalities. Rehabilitation professionals should always use their professional judgment**

- **Patients with this diagnosis are at risk for falls; follow facility protocols for fall prevention and post fall-prevention instructions at bedside, if inpatient. Inform patient and family/caregivers of the potential for falls and educate about fall-prevention strategies. Discharge criteria should include independence with fall-prevention strategies**

- **Aquatic therapy** contraindications/precautions⁽¹³⁾

- Fear of water

- Avoid warm/hot water if patient is pregnant, or has multiple sclerosis, increased risk of hemorrhage (e.g., on anticoagulant medications), impaired thermal regulation, acute inflammation, fever, edema, thrombophlebitis, or acute rheumatoid arthritis

- Epilepsy

- Cardiovascular or pulmonary disease

- Open wounds, catheters, colostomies, IVs, G-tubes

- Urinary or fecal incontinence

- Certain dermatologic conditions (e.g., ichthyosis, infection)

- Venous ulcers

- Tissues damaged by radiation therapy

- Peripheral vascular disease

- Respiratory impairment

- More than half-body immersion during pregnancy
- Clinicians should follow the guidelines of their clinic/hospital and what is ordered by the patient’s physician. The summary below is meant to serve as a guide, not to replace orders from a physician or a clinic’s specific protocols. Therapeutic suggestions in the treatment grid may or may not be appropriate depending on the stage of PD; rehabilitation professionals should always use their professional judgment
- › **Diagnosis/need for treatment**
 - Physical therapy is indicated to address the negative effects of PD on the individual’s physical functioning. The overall goal is to maximize general functional mobility as well as improve posture, flexibility, balance, gait, and ability to perform ADLs
 - Various guidelines include recommendations to start rehabilitation at an early stage of the disease to prevent mobility-related disability and comorbidities^(8,9)
- › **Rule out:** There are numerous conditions the physician needs to rule out prior to making a diagnosis of PD; the following is a partial list⁽⁶⁾
 - Multiple system atrophy
 - Diffuse Lewy body disease
 - Corticobasal degeneration
 - Progressive supranuclear palsy
 - Essential tremor
 - Secondary parkinsonism
- › **Prognosis**
 - PD typically progresses slowly over time, leading to functional impairments and disabilities over the course of several years. Every patient will progress at his or her own rate⁽⁶⁾
 - Compared to patients with tremor as their major symptom, patients with gait or postural instability as their major symptom often have a faster rate of progression. Akinesia is also associated with an advance rate of progression in patients with PD⁽⁹⁾
 - Falls in PD are associated with a poor prognosis, greater disability, and reduced survival⁽²⁶⁾
 - Patients with PD who exercise have lower mortality rates⁽⁹⁾
- › **Referral to other disciplines** (as indicated and appropriate)
 - Occupational therapist
 - Speech therapist
 - Social services
 - Psychiatric services
 - Cognitive psychology
- › **Other considerations**
 - The exercise intervention Agility Boot Camp – Cognitive (ABC-C) has potential to improve the freezing of gait, balance, dual-task cost, and executive function in persons with PD⁽⁴⁰⁾
 - The ABC program is a circuit training program incorporating gait training, functional skills training, agility obstacle courses, lunges, boxing, and adaptive tai chi. The cognitive version of the ABC provides additional executive functional tasks during mobility challenges
- › **Treatment summary**
 - The following treatment summary is centered on interventions for balance and gait impairments in individuals with PD
 - For general treatment information, see *Clinical Review ... Parkinson's Disease: an Overview -- Physical Therapy* ; CINAHL Topic ID Number: T709005
 - For treatment information on motor learning and motor control impairments, see *Clinical Review ... Parkinson's Disease: A Focus on Motor Impairments* ; CINAHL Topic ID Number: T709006
 - Exercise programs
 - Investigators in South Africa found that a home-based balance program was effective in improving some aspects of gait, but that a program supervised by an exercise therapist resulted in greater benefits⁽³³⁾
 - Efficacy of home-based vs therapist-supervised programs on gait parameters, dynamic balance, balance confidence, and motivation was compared in a randomized trial involving 40 individuals with idiopathic PD

- Participants received either 8 weeks of balance training with an exercise therapist (n = 24) or with a DVD used at home (n = 16)
- Outcome measures include the instrumented TimedUpandGo (TUG), Functional Gait Analysis (FGA), Activities-specific Balance confidence (ABC) Scale, and Intrinsic Motivation Inventory (IMI)
- Both groups improved in stride length and FGA. Only the therapist-supervised group showed improvements in ABC, stride velocity, and cadence. Those in the therapist-supervised group also were more motivated
- Researchers in the United States who investigated the effects of progressive resistance exercise (PRE) and a PD-specific multimodal exercise program, modified Fitness Counts (mFC), on spatial, temporal, and stability-related gait impairments in persons with PD found that strength gains do not appear to transfer to gait⁽³⁴⁾
 - Forty-eight participants were randomly assigned to participate in PRE or mFC 2 times a week for 24 months
 - Thirty-eight participants completed the study
 - Outcome measures included gait velocity, stride length, cadence, and double-support time under 4 conditions: off-/on-medication and comfortable/fast speed. Ankle strength was also measured
 - At 24 months, there were no significant differences between exercise groups. Both groups improved fast gait velocity off-medication, cadence in all 4 conditions, and plantarflexion strength off-/on-medication
 - Ankle plantar flexor strength was significantly associated with stride length and gait velocity at baseline and at 24 months; however, changes in strength were not associated with changes in gait
- Tai chi exercise might improve balance, gait, and functional mobility in patients with PD⁽⁴⁴⁾
 - Authors of a 2019 systematic review and meta-analysis found that tai chi exercise can be a good method for reducing falls and improving balance and functional mobility in patients with PD⁽⁴⁴⁾
 - Based on 5 RCT studies
- Authors of a 2017 systematic review of the literature on the effects of tai chi on physical function and well-being among persons with PD concluded that further research is needed with more rigorous study designs, larger sample sizes, adequate tai chi exercise doses, and carefully chosen outcome measures that assess the mechanisms as well as the effects of tai chi, before widespread recommendations can be made⁽³⁵⁾
 - A total of 11 studies with a total of 548 participants met the inclusion criteria. Seven were randomized clinical trials and 4 were quasi-experimental studies
 - Mixed results were reported
 - Overall, participants enrolled in tai chi had better balance and improvement in one or more aspects of well-being
- Dance exercise has been reported to improve balance, ADLs, and mood in patients with PD^(14,15)
 - Virtual-reality dance exercise was reported to have a positive effect on balance, ADLs, and depressive disorder status in a randomized controlled study conducted in the South Korea⁽¹⁴⁾
 - Twenty participants were assigned to an intervention or a control group. Both groups received 30 minutes of physical therapy treatment 5 times per week for 6 weeks. In addition, the intervention group performed 30 minutes of dance exercise 5 times per week for 6 weeks
 - Outcome measures, including the BBS, the Barthel Index, and the Beck Depression Inventory, showed significant differences between groups after treatment
 - Authors of a small RCT conducted in Canada suggest that Argentine tango can improve balance and functional mobility in patients with PD⁽¹⁵⁾
 - Forty patients were randomized to a group that participated in tango classes or a self-directed exercise group for 12 weeks
 - The findings suggest a potential benefit of tango lessons on balance, functional mobility, and satisfaction with care, with possible modest benefits on cognition and fatigue. There were no changes in overall motor severity
 - Authors of a 2017 systematic review and meta-analysis of the effects of dance and of tai chi on functional mobility, balance, and agility in PD reported that dance and tai chi brought no significant differences in balance and agility. Tai chi improved mobility compared with other therapies⁽³⁶⁾
 - 9 studies were analyzed
 - The intervention ranged from 2 weeks to 12 months
- A 12-week mat Pilates (MP) program can improve dynamic balance and strength in the lower limbs for those with PD⁽⁴²⁾

- Mat Pilates is a form of Pilates exercise that is performed on the floor without use of equipment (e.g., reformer). The goal for the MP program is to improve strength, core strength, balance, flexibility, muscular control, posture, and breathing
- Twenty-six patients were equally randomized to either the MP group or control group
- Both groups received treatment twice a week for 12 weeks for 60 minutes for a total of 24 sessions
- Those in the MP group performed floorwork exercises using a medium-resistant exercise band as well as using 0.5kg ankle weights. Seven exercises were performed for 3 sets of 8 repetitions. The exercises consisted of arm arcs, bridge, curl-ups, leg circles, side leg, superman, and squats
- The control group performed calisthenics that consisted of aerobic exercises such as marching in place, articular mobility, and coordinate task functions
- Results at the end of the 12-week session showed significant improvements in BMI, 30-second chair stand test, five times sit to stand test, and TUG for those in the MP group
- A core stability program can improve dynamic balance and confidence in patients with PD⁽⁴³⁾
 - Forty-four participants were equally randomized to either the experimental group (n = 22) or control group (n = 22)
 - Participants performed their respective tasks for 45 minutes, 3 times a week for 8 weeks
 - The core stability program had three phases:
 - Activation of the deep muscles of the body. Pressure biofeedback units such as an inflatable cushion connected to a pressure gauge were used. Subjects were asked to draw the lower aspects of their abdominal muscles towards the spine without moving the trunk or pelvis while maintaining normal breathing. An elastic bag was placed on the lower lumbar level and inflated until the lumbar curve was straight. Using the pressure gauge provided visual feedback to maintain their posture
 - Integrating the deep and superficial stabilizer muscles. This phase followed the same protocol as phase one, but incorporated changes in speed while also incorporating changes in positions (e.g., standing position instead of sitting)
 - Tailored functional exercises in varying environments. The goal of this phase was to improve muscle recruitment while integrating dynamic tasks such as walking in crowds, performing turns, and other standing activities while maintaining appropriate core stability
 - The control group received standard therapy that focused on general exercises, muscle stretching, and motor coordination exercises
 - Results at the end of the study showed improvements in dynamic balance in the experimental group vs. control group and improvements in overall confidence level and maximal excursion of center of pressure in forward, left, and right directions of limits of stability in standing postures
- Balance training
 - The short-term and long-term effects of a task- and context-specific balance training program on dynamic balance and functional performance were investigated in an RCT conducted in China⁽²⁷⁾
 - Seventy nonfallers with PD were assigned either to a balance training group or a control group
 - Balance training group received 4 weeks of indoor and 4 weeks of outdoor balance training, practicing fall-prone activities. Control group received 8 weeks of upper limb training. Training sessions for both groups were 2 hours per week
 - Outcome measures included Mini-BESTest for dynamic balance performance, functional reach test for functional performance, FTSTS test, 1-leg stance test, TUG test, dual-task TUG test, and fall-related outcomes such as rates of total and injurious falls and times to first falls
 - At training completion and at 6 months post training, the balance training group showed significantly greater improvements than the control group in Mini-BESTest scores, functional reach distances, and 1-leg stand times, and had greater time reductions in the FTSTS test, TUG test, and dual-task TUG test
 - The number of injurious fallers was significantly lower in the balance training group at 6-month follow-up
 - Authors of a 2020 systematic review found dual-task training to effectively improve gait performance, motor symptoms, and balance in patients with PD⁽⁴¹⁾
 - Based on 11 RCT studies with 322 patients with PD
- Gait training
 - Mild to moderate treadmill training exercise improves balance, functional capacity, and quality of life in patients with PD⁽⁴⁵⁾
 - Twenty patients with PD were randomized to either the treadmill training (n = 11) (TT) or control group (n = 9)

- The TT group performed moderate intensity (60% of heart rate reserve) exercise on the treadmill. No incline on the treadmill was set. Patients were allowed to hold onto the rails for safety purposes. A safety cable was also attached to the patients, which stops the treadmill if toggled. Sessions were performed twice a week for 30 minutes for 10 weeks
- The control group performed only usual ADLs with no specific intervention
- Results showed significant improvements in functional capacity and balance for the TT group vs control group
- Authors of a 2015 Cochrane systematic review found evidence from 18 trials that the use of treadmill training in patients with PD may improve clinically relevant gait parameters such as gait speed and stride length⁽²⁸⁾
- Secondary variables such as cadence and walking distance were not found to improve
- Comparing physiotherapy and treadmill training against other alternatives in the treatment of gait (e.g., physiotherapy without treadmill training) suggests that treadmill training may be more beneficial in practice without increased risk
- The authors recommend that results be interpreted with caution because it is not known how long these improvements may last and because some studies used no intervention in the control group. In addition, there were variations between the trials in patient characteristics, duration and amount of training, and types of treadmill training used
- Researchers in India found that 4 weeks of partial body-weight-supported treadmill training was superior to conventional gait training in patients with PD⁽²⁹⁾
 - Based on an RCT that involved 60 patients with idiopathic PD
 - Interventions were given for 30 minutes per day, 4 days per week for 4 weeks
 - The main outcome measure was clinical severity as measured by the UPDRS. Gait was also assessed by 2 minutes of treadmill walking and the 10MWT
 - Both groups showed significant improvements in the UPDRS, its subscores, and gait performance; however, the effects of partial body-weight-supported treadmill training were significantly better on most measures
- Researchers in Brazil found that adding load to the ankles of patients with PD doing treadmill training did not influence the results⁽³⁷⁾
 - Based on an RCT that involved 30 individuals
 - Participants were assigned to one of 3 groups: treadmill with no load, additional load equal to 5% of body weight, or additional load equal to 10% of body weight
 - Gait training was performed on the treadmill for 4 weeks, with three 30-minute sessions each week
 - All 3 groups improved. There were no significant differences between groups
- Authors of a systematic review of the literature suggest that dual-task gait training can improve the ability of an individual with PD to complete dual-task activities⁽¹²⁾
 - Dual-task gait training typically involves training the patient to prioritize focusing on the specifics of walking rather than the cognitive task
 - Training tools that may be used for this purpose include patterned movement games such as those for the Nintendo Wii
- Robot-assisted gait training is not superior to balance training for improving postural instability in patients with PD⁽¹⁶⁾
 - Based on an RCT conducted in Italy
 - Sixty-six patients were randomized to a group receiving balance training aimed at improving postural reactions or a group receiving robot-assisted gait training with progressive gait speed increasing and body weight support decreasing
 - The main outcome measure was the BBS. Secondary outcome measures included the ABC scale, the TUG test, and the UPDRS
 - Treatment was 45 minutes long, 3 days per week for 4 weeks
 - Both groups showed improvement. There were no significant differences between the groups for the BBS or the secondary measures either immediately after intervention or at one-month follow up
- Researchers in South Korea found that Nordic walking on a treadmill was beneficial for improving balance and walking in individuals with PD in a randomized trial involving 20 participants with stage 1–3 PD on the Hoehn and Yahr scale⁽³⁸⁾
 - Participants were randomly assigned to do Nordic walking training (NWT), which involves the use of poles in a manner similar to cross-country skiing (n = 10), or to treadmill training (TT) (n = 10)
 - Outcome measures included the motor subscale of the UPDRS, the BBS, the TUG test, the 10 MWT, and the 6 MWT
 - Post intervention the NWT group exhibited greater improvement in the UPDRS-motor, BBS, TUG, 10 MWT, and 6 MWT compared to the TT group
- Hydrotherapy
 - Authors of an RCT study conducted in China found aquatic obstacle training to be more effective than conventional aquatic therapy in improving gait and balance in patients with PD⁽³⁹⁾

- Forty-six patients were randomized to either the aquatic therapy group or obstacle aquatic therapy
- Participants in the aquatic therapy program performed balance training exercises in the pool focusing on trunk mobility, postural stability, and going up/down the stairs of the pool
- Participants in obstacle aquatic therapy performed four different exercises:
 - Slalom walking trials: small plastic objects were placed on the bottom of the pool and participants were asked to slalom (move in a winding path) between them
 - Obstacle circling: a bowling pin was placed in the middle of the pool area and patients were asked to walk toward it and then circle back
 - Crossing over a step: Patients were asked to step over steps
- of various heights: 0.2m, 0.3m, 0.4m
 - Walking back and forth in a straight line in a narrow passageway
 - Results at the end of the 6-month follow-up showed both groups demonstrating improvements, but those in the obstacle aquatic therapy program had significant improvements in Freezing of Gait Questionnaire and the TUG
- Virtual reality
 - In a multicenter RCT, researchers in Italy found that virtual reality (VR) is a feasible alternative to in-clinic sensory integration balance training (SIBT) for reducing postural instability in patients with PD who have a caregiver⁽³²⁾
 - Seventy-six patients in modified Hoehn and Yahr stages 2.5–3 participated
 - Participants were randomized to receive either in-home VR telerehabilitation (n = 38) or in-clinic SIBT (n = 38)
 - VR telerehabilitation consisted of “exergames” using the Nintendo Wii Fit system. SIBT consisted of exercises to improve postural stability
 - Exercises were conducted 3 days a week for 7 weeks in 50-minute sessions
 - Outcome measures included the BBS, the DGI, and fall frequency
 - Both groups showed differences in all outcome measures over time, except for fall frequency
 - The authors concluded that tele-Wii opens new opportunities for treating postural instability, giving individuals access to care from their home, which is especially useful for those living in rural areas

Problem	Goal	Intervention	Expected Progression	Home Program
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<p>Gait deviations and decreased ability to ambulate safely</p>	<p>Improve gait pattern and safety with ambulation as able</p>	<p><u>Therapeutic strategies</u></p> <p>Numerous therapeutic strategies may be employed in an effort to improve gait. The appropriateness of the strategies will vary depending on the stage of the disease. The following is a partial list:</p> <p>Working on dual tasks (e.g., holding an item or performing a cognitive activity during ambulation); this type of activity is not appropriate in more severe cases of PD</p> <p>Careful consideration is required when selecting an assistive device for a patient with PD. Assistive devices may lead to falls if used improperly or if the device does not match the patient's needs</p> <p>Canes, walking stabilizers (vs. walkers), and powered wheelchairs/scooters may be appropriate depending on the level of disability and unique patient circumstances (e.g., cognitive impairment, living environment)</p> <p>(See <i>Treatment summary</i>, above)</p>	<p>As PD is a progressive disease, gait deviations are expected to worsen over time. Progress each unique patient as appropriate and indicated</p>	<p>Recommend strategies for home that address the patient's gait deviations</p>
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<p>Postural instability/ impaired balance; risk for falls</p>	<p>Improve/compensate for postural instability/ impaired balance; reduce risk for falls, improve safety with functional mobility and ADL performance</p>	<p><u>Therapeutic strategies</u> Strategies designed to improve postural instability/balance include but are not limited to:</p> <p>patient education on proper posture and the components of balance (e.g., COM)⁽¹⁾</p> <p>stretching to improve flexibility and posture</p> <p>standing reaching activities⁽¹⁾</p> <p>If patient freezes, provide verbal/auditory cues to assist with gait progression. Use a metronome or marching command.</p> <p>Tandem walking, weight shifting, walking with head turns, obstacle courses</p> <p>(See <i>Treatment summary</i>, above)</p>	<p>As PD is a progressive disease, postural instability/balance is expected to worsen over time. Progress each unique patient as appropriate and indicated</p>	<p>Recommend strategies for home that address the patient's postural instability/impaired balance and risk for falls (e.g., remove throw rugs); educate family and/or caregivers on fall risk</p>
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Desired Outcomes/Outcome Measures

- › Improved gait
 - Gait speed
 - DGI
 - FGA
 - 10MWT
 - Stride length, cadence
- › Improved/compensated for postural instability/impaired balance; reduced risk for falls
 - TUG test
 - FIM
 - ABC Scale
 - BBS
 - BESTest, Mini-BESTest
 - Forward functional reach test

- BFRMDS-UPDRS-3
 - Number of falls, time to first fall
- › Improved ADLs
- Barthel Index
- › Improved quality of life
- PDQ-39

Maintenance or Prevention

- › The patient is advised to follow the prescribed home program and follow up with his or her physician as indicated
- › Implementation of fall-prevention techniques and home modifications

Patient Education

- › Parkinson's Foundation, <http://www.pdf.org/>
- › National Institute of Neurological Disorders and Stroke, <https://www.ninds.nih.gov/Disorders/all-disorders>

Coding Matrix

References are rated using the following codes, listed in order of strength:

M Published meta-analysis	RV Published review of the literature	PP Policies, procedures, protocols
SR Published systematic or integrative literature review	RU Published research utilization report	X Practice exemplars, stories, opinions
RCT Published research (randomized controlled trial)	QI Published quality improvement report	GI General or background information/texts/reports
R Published research (not randomized controlled trial)	L Legislation	U Unpublished research, reviews, poster presentations or other such materials
C Case histories, case studies	PGR Published government report	CP Conference proceedings, abstracts, presentation
G Published guidelines	PFR Published funded report	

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