

What is Balance?

Balance is defined as the ability to maintain the body's center of mass over its base of support.

(Shumway-Cook, 2001)

B * W E S
IN HOME CARE
HEALTHCARE RE-IMAGINED





Good Balance

Exists when multiple systems interact flawlessly and automatically, providing accurate and exact information to our nervous system:

- The brain receives information from our sensory receptors located in the eyes, inner ears, joints, muscles, and skin
- Cognitive factors such as fear of falling, dementia, medications, and medical conditions affect balance

Effectively Assessing Fall Risk

Requires a holistic approach:

- Falls are the result of impairment in one or more complex and interrelated physiologic systems as well as environmental factors
- **Internal risk factors:** cardiovascular, neuromuscular, orthopedic, perceptual, and psychiatric or cognitive impairments
- **External risk factors:** medications, assistive devices, environmental hazards, and level of care

Internal Risk Factors

| TABLE 1: INTERNAL RISK FACTORS FOR FALLS | |
|--|--|
| Internal Risk Factors | Considerations |
| Cardiovascular | Dysrhythmias |
| Nueromuscular | Lower extremity weakness, loss of movement, functional decline, hypotension, CVA, Parkinson's, stroke, neurological disorders, seizure disorder, syncope, unsteady gait, chronic/ acute conditions |
| Orthopedic | Joint pain, arthritis, hip fracture, limb amputation, osteoporosis, foot disabilities |
| Perceptual | Impaired hearing, impaired vision, somatosensory deficits, neuropathies, dizziness/vertigo |
| Psychiatric or Cognitive | Delirium, cognitive decline, dementia, Alzheimer's disease, depression, wandering, confusion/disorientation, fear of falling |
| Medication Side Effects | Hypotension, muscle rigidity, impaired balance, extrapyramidal symptoms (tremors, uncontrolled movements), decreased alertness |

External Risk Factors

| TABLE 2: EXTERNAL RISK FACTORS FOR FALLS | |
|--|--|
| External Risk Factors | Considerations |
| Medications | Psychotropic, cardiovascular meds, diuretics, antidepressants, antianxiety/hypnotics, ETOH/drug abuse |
| Appliances and Devices | Pacemaker, cane/walker/crutch, restraints, poor fitting wheelchair |
| Environmental Hazards | Glare, poor lighting, slippery floors, uneven surfaces, patterned carpets, foreign objects, recent move into or within a facility, proximity to aggressive patients, time of day, time since meals, type of activity, walking in a crowded area, reaching, bladder/bowel urgency |

Interdisciplinary Approach

Targeting risk factors for falls and designing intervention requires a multidisciplinary approach:

- Proper intervention has been shown to reduce falls up to 50% in high-risk groups with 3 or more falls the prior year (Ray, 1997)
- Utilization of a multidisciplinary approach to the assessment of falls means that therapy, nursing, nursing assistants, physicians, and other staff members communicate regularly

Assessment of Risk Factors

To improve communication, designate the responsibility for assessment of the risk factors associated with falls, as shown in Table 1 and Table 2 (on previous page) between nursing and therapy

Comprehensive Balance Assessment: An Integral part of the Physical Therapy Evaluation

- Subjective
- Musculoskeletal evaluation
- Sensory systems used for balance
- Functional mobility

The Subjective Assessment

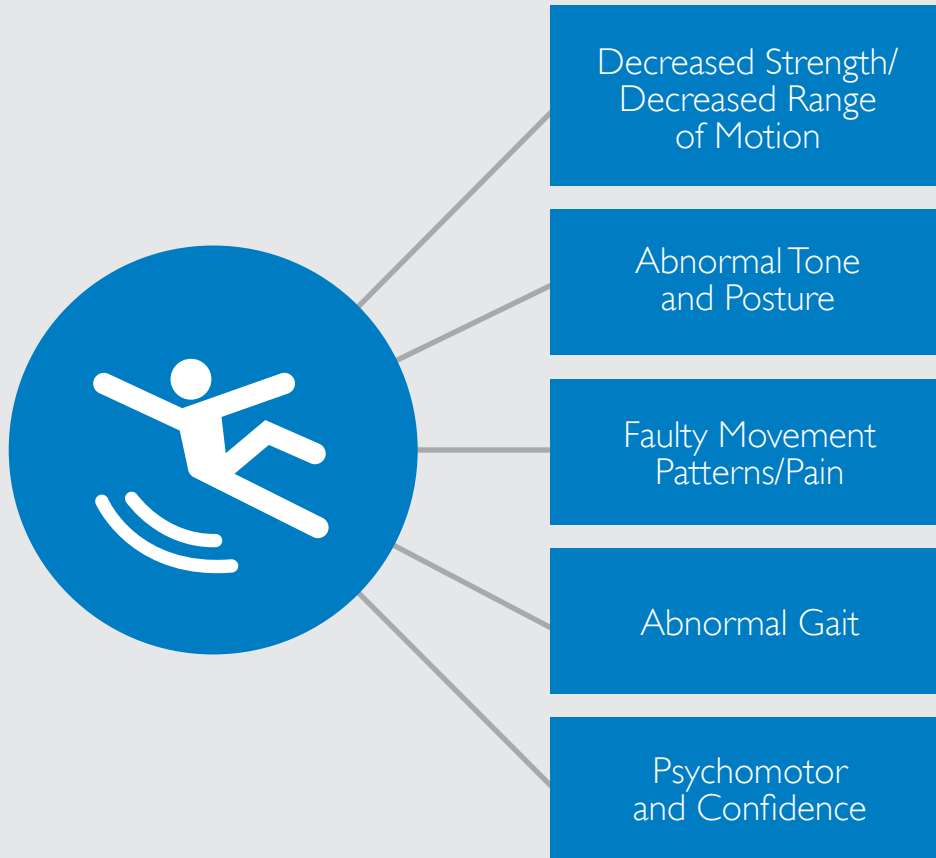
- Past medical history: diseases or disorders that lead to weakness or loss of feeling such as peripheral neuropathy, vascular disorders, and visual deficits
- Recent history of falls: where and when the falls have occurred, type of lighting, type of surface, time of day, footwear, tasks being performed
- Pain complaints or swelling complaints that can lead to decreased sensory input

Review of Medications

- Particular attention to medications that affect blood pressure, cardiac function, cognition, as well as those with the side effects of dizziness and lightheadedness
- Checking vitals: temperature, blood pressure, heart rate, and respiratory rate

Musculoskeletal Assessment

Faults Leading to Increased Number of Falls



Strength and Range of Motion Assessment

STRENGTH

- Manual muscle testing should be used to identify gross muscle weakness
- Focus on timing and sequence of muscle firing
- Use closed chain or weight bearing positions to give a better picture of functional limitations

RANGE OF MOTION

- Decreased range of motion can lead to postural compensations that affect the ability to react quickly to losses of balance
- Check Achilles tendon shortening which leads to decreased dorsiflexion, hip flexor shortening and decreasing hip extension

Muscle Tone

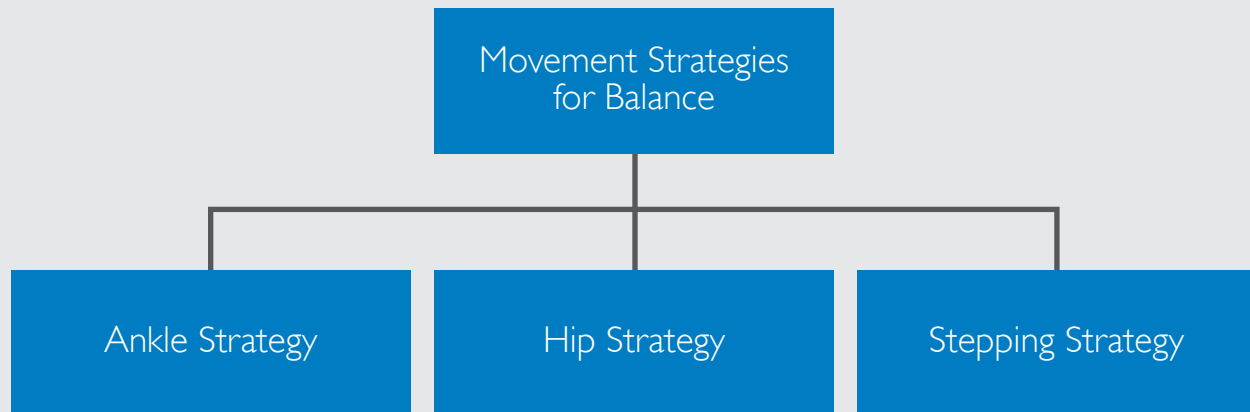
Abnormal tone can lead to:

- Shifting of weight away from or onto the affected side
- Loss of timing or incorrect timing of muscle contractions
- Loss of the ability to react quickly to disruptions of balance

Posture

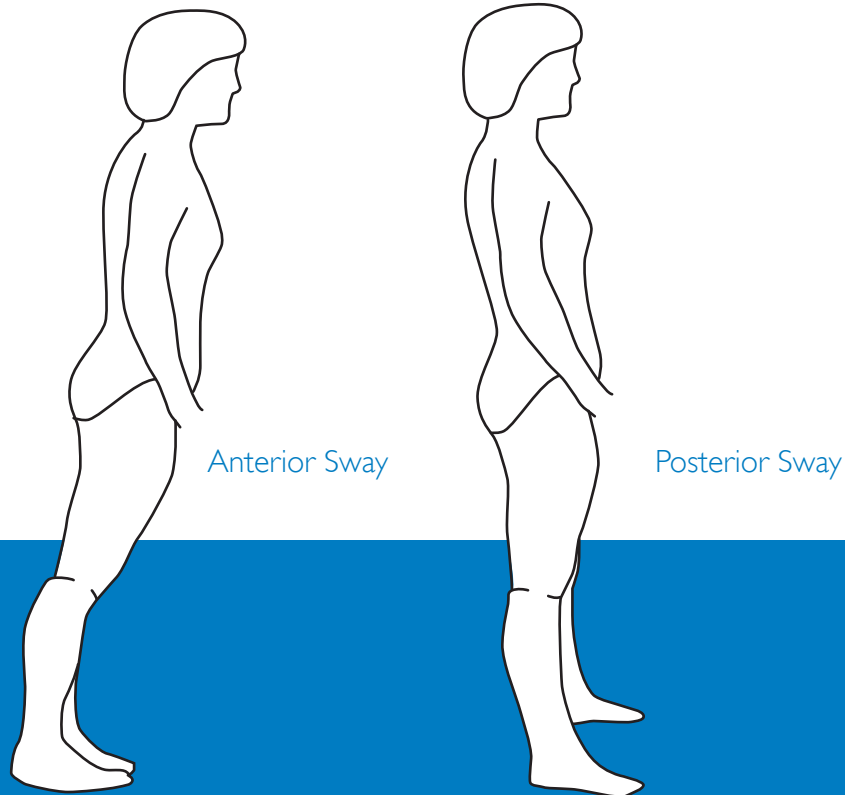
- Postural abnormalities such as kyphosis and scoliosis
- Loss of motion in the postural muscles such as low back, hips, legs, and ankles

Movement Patterns for Balance



Ankle Strategy or Ankle Sway

- Responds to minor losses of balance
- Adjusts balance in quiet standing
- A **loss of balance in the forward direction** causes contraction of the gastrocnemius, hamstrings, and lower back muscles in that order to bring the body back into balance
- A **loss of balance in the backward direction** causes a contraction of the anterior tibialis, quadriceps, and lower stomach muscles in order to bring the body back into balance



Hip Strategy

- Used with larger losses of balance
- Activation of the muscles is from proximal to distal
- When a walker is used the body abandons the ankle strategy and relies heavily on the hip strategy
- This dependence may lead to a further loss of balance secondary to decreased ankle sway and increased ankle weakness and loss of motion

Stepping Strategy

- This strategy is used by the nervous system when the loss of balance exceeds the area of stability and the person is forced to step or fall

Pain

- Disrupts the normal function of involved joints and causes a shifting of body weight to the unaffected side
- Interrupt normal sensory and proprioceptive feedback
- Affects the ability to react appropriately to perturbations

Abnormal Gait

- Decreased dorsiflexion at heel strike, decreased planterflexion at push off
- Decreased step length
- Decreased weight shifting
- Decreased walking speed

Walking Speed

- Reliable (Richards 1996)
- Valid (Steffen 2002)
- Sensitive (Van Lersel 1995)
- Specific (Harada 1995)
- Correlates with
 - Functional ability (Perry 1995)
 - Balance confidence (Mangione 2007)

Walking Speed: Predictive

- Functional and physiological changes (Perry 1995)
- Potential for rehabilitation
- Aids in the prediction of
 - Falls
 - Fear of falling



Confidence

- Psychomotor changes include loss of confidence or changes in the client's perceived limits of stability

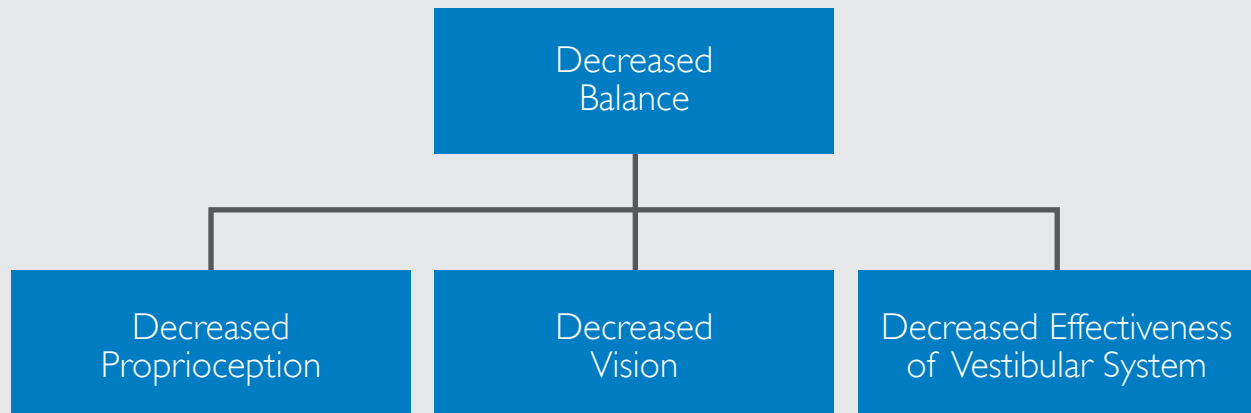
A person's stability may be affected by fear of falling even when the physical ability exists to safely perform a task.

OR

A person may not have an accurate idea of the limits of their stability and have little sense of when loss of stability is occurring leading to falls



Examination of the Sensory System and its Contribution to Balance: Somatosensory, Visual, and Vestibular



Proprioception

- Decreased number of receptors in lower extremities
- Decreased sensation from other comorbidities

IMPLICATIONS FOR TREATMENT:

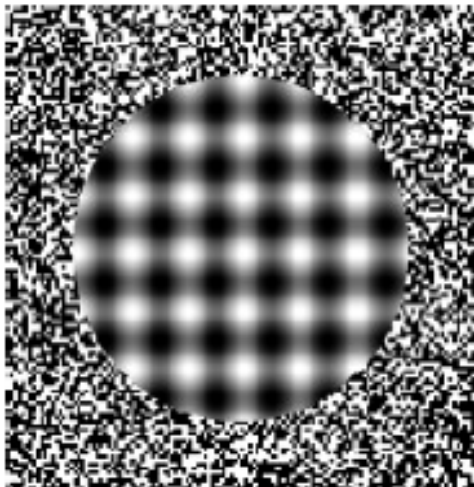
- Proprioception is more accurate with weight bearing
- Weight bearing will increase receptor activation

Vision

- Vision declines progressively after age 50
- Decreased acuity
 - Decreased contrast sensitivity
 - Decreased depth perception
 - Decreased glare sensitivity
 - Increased time required for light and dark adaptation
 - Decreased light entering the eye due to opacities

Aging and Vision

- Impaired depth perception is one of the most common visual risk factors for multiple falls in community dwelling older adults



What is the Vestibular System?

- 3 major components
- Peripheral sensory apparatus
- Central processor
- Mechanism for motor output

How Does Aging Affect the Vestibular System?

- Hair cells (sensory receptors) decreased by 40%
 - Otolith organs
 - Semicircular canals
 - Permanent loss
- Neurons decrease by 3% each decade in the vestibular system
- Inactivity leads to lack of stimulus to the vestibular system

Functional Mobility Assessment

- Berg functional mobility test
- Tinetti balance tests
- Reach test
- Functional gait test/walking speed

Intervention

- Individualized treatment program
- Therapeutic exercises: strength, range of motion, coordination, static and dynamic balance, posture/alignment, as well as neuromuscular re-education
- Modifications to home environment
- Increase safety awareness
- Medication review

Treating Balance Impairments

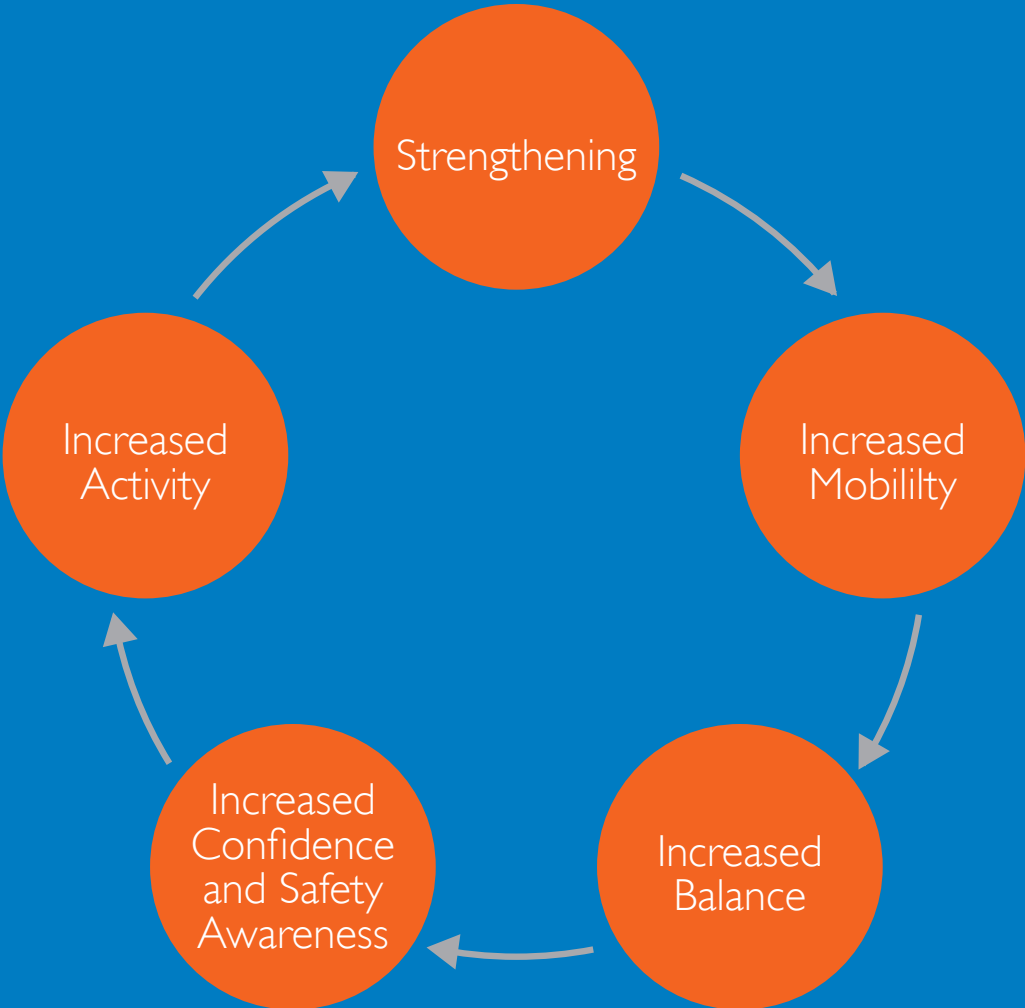
- Rule #1: If you don't challenge the patient they will not get better
- Rule #2: If the brain does not know what is wrong, then it won't know what to fix
- Bring the patient to their limits
- They NEED to experience a loss of balance (within a safe environment)
It is those "error" messages that will "re-train" the system
- Prepare them for the "real world"



The Goal: Break the Cycle of Falling



Create the Cycle of Activity



Yoga is the study of balance,
and balance is the aim of all
living creatures: it is our home





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